EXHIBIT 4
PUBLIC REDACTED VERSION

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN FRANCISCO DIVISION

STATE OF UTAH
160 E 300 S, 5th Floor
P.O. Box 140872
Salt Lake City, UT 84114

STATE OF NEW YORK
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New York, NY 10005

STATE OF NORTH CAROLINA
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Raleigh, NC 27602

STATE OF TENNESSEE
P.O. Box 20207
Nashville, TN 37202

STATE OF ARIZONA
2005 North Central Avenue
Phoenix, AZ 85004

STATE OF COLORADO
1300 Broadway, 7th Floor
Denver, CO 80203

STATE OF IOWA
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Des Moines, IA 50319

STATE OF NEBRASKA
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Lincoln, NE 68509-8920

STATE OF ALASKA
1031 W. Fourth Avenue, Suite 200

Case No. 3:21-cv-05227

Anchorage, AK 99501

STATE OF ARKANSAS
323 Center Street, Suite 200
Little Rock, AR 72201

STATE OF CALIFORNIA
455 Golden Gate Ave, Suite 11000
San Francisco, CA 94102

STATE OF CONNECTICUT
165 Capitol Avenue
Hartford, CT 06106

STATE OF DELAWARE
820 N. French St., 5th Floor
Wilmington, DE 19801

DISTRICT OF COLUMBIA
400 6th Street, N.W, 10th Floor
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STATE OF FLORIDA
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STATE OF WASHINGTON
800 Fifth Ave., Suite 2000
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STATE OF WEST VIRGINIA
812 Quarrier St., First Floor
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Charleston, WV 25326

    Plaintiffs,

v.

GOOGLE LLC, GOOGLE IRELAND
LIMITED, GOOGLE COMMERCE
LIMITED, GOOGLE ASIA PACIFIC
PTE. LIMITED, GOOGLE PAYMENT
CORP., and ALPHABET INC.,

Defendants.

Rebuttal Expert Report of Dr. Marc Rysman

December 23, 2022

Table of Contents

NON-PARTY AND PARTY HIGHLY CONFIDENTIAL – OUTSIDE COUNSEL EYES ONLY

I.   Introduction

1.   At the request of the Attorneys General for 39 states, commonwealths, and districts of the United States (hereafter, the "States"), I submitted a report on October 3, 2022, in which I offered opinions on the competitive effects of certain alleged anticompetitive conduct by Google in relation to the Google Play Store and Google Play Billing and quantified damages resulting from this challenged conduct.[1] I described my qualifications in that report, and I include my updated CV as Appendix A to this report.

2.   In my Opening Report, I concluded that Google engaged in anticompetitive conduct that caused harm to competition and harmed Android smart mobile device users in the U.S. and worldwide (excluding China). I determined that the markets for Android App Distribution and Android In-App Billing Services worldwide (excluding China) are relevant antitrust markets for evaluating Google's challenged conduct. I also demonstrated that Google has substantial market power in these markets and that non-Android app stores do not constrain Google's market power in these markets. I also concluded that Google uses its market power in Android App Distribution to tie the use of its app distribution services to the use of Google Play Billing for in-app digital content purchases on apps distributed through the Google Play Store.

3.   On November 18, 2022, Google served reports from seven consultants.[2] Since then, Google has also served a supplemental report and an errata to another report.[3] In this report, I have been asked to evaluate the analyses and opinions put forward by certain of Google's consultants, particularly Dr. Catherine Tucker, who offered opinions on market definition and

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[1] Expert Report of Dr. Marc Rysman, October 3, 2022 ("Rysman Opening Report" or "my Opening Report").

[2] Expert Report of Catherine E. Tucker, November 18, 2022 ("Tucker Report"); Expert Report of Matthew Gentzkow, November 18, 2022 ("Gentzkow Report"); Expert Report of Dr. Gregory K. Leonard, November 18, 2022 ("Leonard Report"); Expert Report of Donna L. Hoffman, Ph.D., November 18, 2022 ("Hoffman Report"); Expert Report of Douglas J. Skinner, November 18, 2022 ("Skinner Report"); Expert Report of Sandeep Chatterjee, Ph.D., November 18, 2022 ("Chatterjee Report"); and Expert Report of Zhiyun Qian, November 18, 2022 ("Qian Report").

[3] Supplement to Initial Expert Report of Matthew Gentzkow, December 7, 2022 ("Gentzkow Supplement"); Expert Report of Dr. Gregory K. Leonard Errata, November 30, 2022 ("Leonard Errata").

market power; Dr. Matthew Gentzkow, who offered opinions on the competitive effects of

Google's challenged conduct; Dr. Gregory Leonard, who offered opinions on damages; and only

to the extent relevant to my economic analysis, Dr. Zhiyun Qian and Dr. Sandeep Chatterjee,

who offered opinions on certain technical issues. In evaluating the arguments put forward by

Google's consultants, I have relied upon the evidence cited in Appendix B of the Rysman

Opening Report, as well as additional documents in the record, deposition testimony,[4] evidence

presented by Google's consultants, and my review of the backup electronic productions

accompanying Google's reports. Appendix B contains a list of new materials that I have relied

upon in forming my opinions since my Opening Report.

II.   Summary of Opinions

4.   Based on my analyses presented in this report and those summarized in my

Opening Report, my review of the reports Google submitted, my continued review of the record

evidence, and my experience as an industrial organization economist, it remains my opinion that

Google (i) holds market power in two relevant antitrust markets, each of which is pertinent to

evaluating the effects of Google's challenged conduct; (ii) engaged in a combined course of

anticompetitive conduct through which it restricted competition by imposing barriers in each

Android app distribution channel and maintained market power in the market for Android App

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[4] Deposition of Brian Vogelsang, Former Product Manager for Plaza Retail - Qualcomm Incorporated, November 10, 2022 (hereafter "Vogelsang Deposition"); Deposition of James Kolotouros, Vice President, Android Platform Partnerships at Google, February 2-3, 2022 (hereafter "Kolotouros (Google) Deposition"); Deposition of Christopher Dury, CEO at GetJar, September 16, 2022 (hereafter "Dury (GetJar) Deposition"); Deposition of Christian Cramer, Finance Director for Play at Google, January 13-14, 2022 (hereafter "Cramer (Google) Deposition"); Deposition of Lawrence Koh, General Manager and Head of FIFA Mobile at EA and formerly Director and Global Head of Games Business Development at Google, December 9, 2021 (hereafter "Koh (Google) Deposition"); Deposition of George Christopolous, Founder of SlideME, September 9, 2022 (hereafter "Christopolous (SlideME) Deposition"); Deposition of David Kleidermacher, Vice President, Engineering, at Google, February 3-4, 2022 (hereafter "Kleidermacher (Google) Deposition"); Deposition of Aashish Patel, Director of Product Management at NVIDIA, September 29, 2022 (hereafter "Patel (Nvidia) Deposition"); Deposition of Ben Goodger, General Manager, Engineering, Product and Developer Relations at Google, September 7, 2022 (hereafter "Goodger (Google) Deposition"); Deposition of Kaori Miyake, Head of Product Communications, Android and Google Play, November 1, 2022 (hereafter "Miyake (Google) Deposition"); Deposition of Christopher Babcock, Senior Platform Engineer at Epic Games, February 17, 2022 (hereafter "Babcock (Epic) Deposition").

Distribution; (iii) tied the use of Google Play Billing to its app distribution services; and, through this collective challenged conduct, (iv) caused harm to competition and consumers.

5.   I find the opinions of Google's consultants flawed and unconvincing. In particular, Dr. Tucker focuses her analysis on the entire "Android Ecosystem," which leads her to define an overly broad relevant product market consisting of "facilitation of digital transactions," a market that is vague and could include transactions that could never be transacted by a retail consumer or on a mobile phone.[5] By contrast, my market definition follows standard practice by beginning with products at issue in this case, the Google Play Store and Google Play Billing, and then identifying the relevant substitutes for those products. I then test whether I have defined the markets in an artificially narrow way and find that I have not. This is the approach suggested by the *U.S. Merger Guidelines*. Dr. Tucker, on the other hand, begins her analysis with the entire Android ecosystem and then insists there are numerous competitive constraints on Google, including Apple, which she claims I have not properly accounted for in assessing market definition. However, even firms with extensive market power can face hypothetical substitutes that nevertheless do not constrain their ability to control price and other transaction terms in their relevant market. In my Opening Report, I concluded that substitution to products outside my proposed markets could not constrain the prices of a hypothetical monopolist in those proposed markets.[6] Nevertheless, I evaluate Dr. Tucker's evidence regarding these competitive constraints and find they do not alter my opinion regarding the relevant markets at issue.

6.   Dr. Tucker also claims that the Android App Distribution and In-App Billing Services product markets should not be studied separately because they are part of the same ecosystem and that, by separating them, I ignore the inter-relationships between the two.[7] However, I explicitly acknowledge the relationships between the two markets: developers and

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[5] Tucker Report, § III.C.
[6] Rysman Opening Report, ¶ 231.
[7] Tucker Report, § III.C.

consumers must first interact in app distribution before developers need in-app billing services. The two products are complements, not substitutes. There is therefore no need to include them together in a single market. Further, I find that Dr. Tucker's assertion that the relevant geographic market should be limited to the United States would not materially change my opinions with respect to Google's market power and the effect of its challenged conduct on competition and consumers.[8]

7.   Finally, Dr. Tucker's position that Google lacks market power in the relevant markets suffers several flaws.[9] Her estimated market shares are based on an overly broad market; she overstates the ability of sideloading, pre-installation, and alternative app stores to constrain Google's market power; and her arguments regarding Google's commission, output, and innovation are uninformative because they do not compare Google's actual world commission, output, and innovation with an appropriate competitive benchmark.

8.   Dr. Gentzkow presents an analysis of Google's challenged conduct using standards that appear to find no conduct anticompetitive. He claims Google's pricing structure enables it to earn a return on its investment in the Google Play Store and Android ecosystem "while aligning the incentives of users and app developers to create as much value as possible for the platform as a whole,"[10] and presents five factors for evaluating Google's commission rate structure to demonstrate it is "effective."[11] Although Dr. Gentzkow cites my work as support in part of this five-factor test, in fact, Dr. Gentzkow's factors appear designed to fit the way Google has chosen to structure its business.

9.   Moreover, even if Dr. Gentzkow were correct that the challenged conduct helped develop the Android ecosystem, his five factor test does not address whether prices are set by competition and is irrelevant to antitrust evaluation. Furthermore, Google's experts provided no

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[8] Tucker Report, § VII.

[9] Tucker Report, § VIII.

[10] Gentzkow Report, ¶ 27.

[11] Gentzkow Report, ¶¶ 144-154.

quantitative analysis to support the conclusions that Google's challenged conduct helped lower the price for Android smart mobile devices or increased the adoption of the Android OS.

10.   In evaluating Google's challenged conduct, Dr. Gentzkow considers each element of Google's challenged conduct separately, ignoring the anticompetitive impact of its conduct as a whole. He contends that "availability" of alternative app distribution channels is sufficient to find there is no harm to competition, regardless of the quality or accessibility of these alternatives and despite the fact that Google's conduct has effectively foreclosed each of these alternatives from obtaining meaningful market share.[12] He speculates – without evidence - that users and developers *could* be worse off in the but-for world if Google changed conduct that is not at issue. That flawed comparison leads to incorrect conclusions. Finally, the limited empirical evidence he does present is inconsistent or incorrect.

11.   Dr. Leonard responds to my damages analysis and proposes his pass-through model quantifying overcharge damages to consumers.[13] Dr. Leonard misrepresents my benchmarking method for the but-for commission of 15%. He claims that I have used other mobile app stores and game platforms as benchmarks to estimate a 15% commission in the but-for world.[14] But, in fact, I have used Google's own reduced commission rates introduced in the last few years and referenced extensively in its own documents as a conservative benchmark showing what Google's global commission rates would be in the but-for world, which is in line with Dr. Leonard's approach to benchmarking.

12.   Dr. Leonard repeatedly states that my damages model assumes a 100% pass-through rate, which is also incorrect. I illustrated damages estimates using 0% and 100% pass-through rates to show that price and variety trade-off. To be extremely conservative, I calculated harm to consumers in the plaintiff States in the damages period using a 0% pass-through rate. Dr.

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[12] Gentzkow Report, § VI.

[13] Leonard Report, §§ VII, VIII, IX, and XI.

[14] Leonard Report, Table 9.

Leonard's damages quantifications completely ignore any effect of Google's anticompetitive conduct on consumers in the form of lost variety.

13.   Dr. Leonard also calls my damages model 'stylized,' claims that it does not account for heterogeneity across apps, and argues that I impose unsupported simplifying assumptions for the sake of analytical tractability. Those claims are incorrect. My model is derived from Church and Gandal (1993), which is a model of monopolistic competition between software developers in choosing a platform on which to publish.[15] A model of monopolistic competition fits the Android App Distribution Market because Android apps are not all perfect substitutes for each other. Thus, the model is heterogenous from the outset, but looks at the Android ecosystem as a large economic system, akin to a trade or macroeconomic model, where economists abstract from issues that are not critical to the goals of the model. And other economists have recently calculated a loss in consumer welfare from a decrease in the number of apps on the Google Play Store. Dr. Leonard also fails to acknowledge the many conservative assumptions that I have made.

14.   Finally, Dr. Leonard claims that my damages model does not account for consumer search costs and direct network effects that he claims could reduce consumer welfare in the but-for world. However, he does not provide any evidence that these are indeed concerning for Google. He proposes two adjustments of my model to make his point, neither of which fit the facts of this case. Thus, I find that Dr. Leonard's criticisms are unsupported and do not alter my opinion that consumers were substantially harmed as a result of Google's conduct.

15.   Though, in what follows, I put forth significant criticisms of Google's experts' opinions, I think it is helpful to outline some of the significant points upon which we appear to agree. We appear to agree on the following facts (when Google's consultants opined on them):

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[15] *See* Rysman Opening Report, ¶ 487 (citing to Church, Jeffrey and Neil Gandal. "Complementary network externalities and technological adoption," *International Journal of Industrial Organization*, Vol. 11, No. 2, 1993, pp. 239-260), § IX.A .

- Google's conduct affects the number of apps in the Android ecosystem.[16]

- Consumers value the variety of apps and in-app content available to them.[17]

- Economics supplies valid methods for determining the number of firms (or in this case the number of apps) that will enter a market.[18]

- Economics offers tools to express in dollars the value that consumers place on variety.[19]

- Google's own fees and discounts provide valid counterfactual fees for use in conservatively estimating damages, even if we disagree on exactly which of its fees should be used.[20]

While Google's experts may criticize details of how I implemented my calculations (which, as I discuss below, I do not find to be valid criticisms), there is no dispute about the basic idea that, in general, economics provides valid tools for making these calculations.

16.   Finally, reports from Google's consultants and accompanying exhibits and appendices total approximately 2,700 pages, and their accompanying production, which Google's experts have provided on a rolling basis, totaled more than 90 GB. Consequently, I do not respond herein to all the details and analyses underlying each of their opinions, but instead I

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[16] Tucker Report, §§ IV.C.3-5; Gentzkow Report, ¶ 85.

[17] Tucker Report, §§ IV.C.5; Gentzkow Report, 138. See, also Jean-Charles Rochet and Jean Tirole, "Platform Competition in Two-Sided Markets," *Journal of the European Economic Association*, Vol. 1, No. 4, 2003, pp. 990-1029, at pp. 990-991.

[18] *See, e.g.*, Berry, Steven, and Peter Reiss, "Empirical Models of Entry and Market Structure," Chapter 29, *Handbook of Industrial Organization*, Vol. 3, 2007, pp. 1845-1886, at 1873 - 1877.

[19] *See, e.g.*, Mas-Colell, Andreu, Whinston, Michael D., and Green, Jerry R., "Microeconomic Theory," Oxford University Press, June 1995 (hereafter "Mas-Colell et al (1995)"), pp. 80-91; Varian, Hal R., "Intermediate Microeconomics: a Modern Approach," Eighth Edition, New York, NY:W.W. Norton & Company, 2010 (hereafter "Varian (2010)"), pp. 258-262. *See also*, Hausman, Jerry A., and Leonard, Gregory K., "The Competitive Effects of a New Product Introduction: A Case Study," *The Journal of Industrial Economics*, Vol. L, No. 3, September 2002, 237-263, p. 237; Petrin, Amil, "Quantifying the Benefits of New Products: The Case of the Minivan," *Journal of Political Economy*, Vol. 110, No. 4, August 2002, 705-729, p. 705 (computing compensating variation from the introduction of minivans); and Lee, Robin S., "Vertical Integration and Exclusivity in Platform and Two-Sided Markets," *American Economic Review*, Vol. 103, No. 7, December 2013, 2960-3000, pp. 2965 and 2994 (computing consumer welfare from access to software variety in the context of console video games).

[20] Leonard Report, ¶ 178.

focus on the most substantive criticisms and opinions by Google's experts. Any lack of response on any particular issue, detail, critique, or opinion by Google's experts is not, and should not be interpreted as, agreement with those issues, details, critiques, or opinions. I stand by the conclusions of my Opening Report, to which these reports purport to respond. My work is ongoing, and I will continue to review the reports of Google's consultants and the discovery record to understand the evidence in this case. I reserve the right to supplement and to amend my opinions.

17.   The remainder of this report details in greater depth the analyses underlying my opinions. In Sections III and IV, I consider the opinions of Google's experts on relevant markets and Google's market power in those markets. In Section V, I consider Google's experts' conclusions on whether Google engaged in anticompetitive conduct and caused harm to competition. In Section VI, I evaluate the damages assessment in the Leonard Report. Throughout, I highlight key flaws in Google's experts' analyses and findings and explain how their conclusions do not alter my opinions. In Section VII, I conclude.

III.   Android App Distribution and Android In-App Billing Services are Relevant Antitrust Markets

A.   Overview

18.   In my Opening Report, I determined the relevant antitrust markets for evaluating the effect of Google's challenged conduct. The first is the market for the distribution of Android apps on Android smart mobile devices worldwide (excluding China) (the "Android App Distribution Market"). I included in this market the Google Play Store, OEM and third-party Android app stores, pre-installation, and sideloading.[21] This is based on my assessment that these are the distribution channels that would be viable substitutes for the Google Play Store in the absence of Google's challenged conduct.

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[21] Rysman Opening report, ¶ 142 and Exhibit 18.

19.   The second is the market for in-app billing services for purchases of digital in-app content through apps on Android smart mobile devices worldwide (excluding China) (the "Android In-App Billing Services Market").[22] This market includes: (i) Google Play Billing; (ii) billing service systems provided by other Android app stores; (iii) developers' own billing service systems; and (iv) independent billing service providers.[23] It is my opinion that but for Google's tying of Google Play Billing to distribution on Google Play, those other in-app billing services would be viable substitutes for Google Play Billing.

20.   I presented both empirical and qualitative evidence supporting the existence of these markets. In line with standard economic analysis of relevant markets, I asked whether a hypothetical monopolist of both markets would find it profitable to impose a combined 10% SSNIP (small but significant and non-transitory increase in price) across Android App Distribution and Android In-App Billing Services.[24] I found that the 10% combined SSNIP across both markets would be profitable, and hence the combined market is not subject to any significant constraints, such as the Apple App Store and associated billing services.[25] I also concluded that Android App Distribution and In-App Billing Services are separate and distinct product markets, as the products are complements with separate demand.[26] In addition to the SSNIP analysis, I also found that Android users face high costs if they wish to switch from Android to iOS, and that there is limited switching / substitution between Android and iOS devices.[27] In addition, I found that PCs or gaming consoles are not a substitute for Android App Distribution due to the differences between their apps and OSs, and that substitution between web-based apps and mobile apps is limited.[28]

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[22] Rysman Opening report, ¶ 10.

[23] Rysman Opening report, ¶ 10.

[24] Rysman Opening report, ¶ 11.

[25] Rysman Opening report, ¶ 11.

[26] Rysman Opening report, ¶ 11.

[27] Rysman Opening report, ¶¶ 186 - 191.

[28] Rysman Opening report, ¶¶ 198 - 218.

21.   I concluded the relevant geographic market is worldwide excluding China. Given that Android can reach a global audience and developers want to reach as many users as possible, their incentive is to make their apps available globally. In-app billing service providers also offer their services worldwide and could do so absent Google's conduct. I also understand that the Google Play Store and Google Play Billing are unavailable in China.[29] I therefore defined global markets excluding China for both Android App Distribution and In-App Billing Services.[30]

22.   Dr. Tucker presents various criticisms of my market definition analysis. Dr. Tucker begins her criticism with a list of app distribution channels, including Apple, that she believes act as competitive constraints in what she determines to be the relevant antitrust market.[31] She takes the position that the relevant product is "facilitation of digital content transactions" and contends that the Android App Distribution and Android In-App Billing Services Markets that I define should be combined and expanded to include the competitive constraints she alleges.[32] Dr. Tucker also claims that the relevant geographic market should be limited to the United States.[33]

23.   I have considered Dr. Tucker's criticisms and conclusions, and, as I explain in further detail in the sections below, I find her criticisms to be without merit and find her conclusions inconsistent with the evidence. In particular:

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[29] Gentzkow Report, ¶ 641 ("Government restrictions in China mean users cannot access Google Play and have limited access to Google apps and services."). *See* "How to Access Google Play Store in China," VPNDada, available at https://www.vpndada.com/access-google-playstorechina/ ("If you buy an Android phone in China today, you won't find the Google Play app store preinstalled on that phone. Instead, depending on the brand of the phone, it will come with some other app stores, mostly likely one offered by a Chinese company. If you own an Android phone purchased outside of China which has Google Play preinstalled, when you visit China, you will find that you can no longer use it.").

[30] Rysman Opening report, ¶ 12.

[31] Tucker Report, §§ IV and V.

[32] Tucker Report, §§ III.B.1 and VI.C.

[33] Tucker Report, § VII.

- I start out by emphasizing that I have performed a hypothetical monopolist test (HMT), including a quantitative calculation that indicates that a hypothetical monopolist would raise price in the relevant markets by at least a SSNIP. The SSNIP analysis provides a framework for evaluating whether the evidence in this case indicates that my proposed markets need to be expanded to include additional products. Because I found that a hypothetical monopolist would find it profitable to impose a SSNIP, my markets do not need to expand to include Dr. Tucker's proposed competitive constraints to Google's market power. I address Dr. Tucker's criticisms of my SSNIP calculation in Section III.B.

- Dr. Tucker focuses market definition on identifying actual and potential competitors to Google across the Android ecosystem (including smart mobile devices and mobile OSs) rather than on the forces of demand substitution relevant to my proposed markets. As I explained in my Opening Report, "[m]arket definition typically centers on demand-side substitution, evaluating the reasonably interchangeable choices available to consumers, such that they would form a relevant antitrust market."[34]

- Dr. Tucker falls for the Cellophane Fallacy; she mistakes limited substitution away from Android devices to Apple devices or to other platforms in the actual world, where Google has exercised its market power, for evidence of substitution that would occur in a but-for competitive setting. I review her specific evidence related to this in Sections III.C.1III.C to 112.

- Dr. Tucker's claim that dividing Android App Distribution and Android In-App Billing Services into two markets divides "Google's Android ecosystem … arbitrarily"[35] is not correct. In fact, by defining two markets, I account for the relationship between the parts of "Google's Android ecosystem" that are relevant to understanding the challenged

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[34] Rysman Opening Report, ¶ 117 (citing to U.S. Department of Justice and the Federal Trade Commission, "Horizontal Merger Guidelines," August 19, 2010, available at https://www.justice.gov/atr/horizontal-merger-guidelines-08192010, (hereafter, "U.S. Merger Guidelines"), § 4).

[35] Tucker Report, ¶ 32.

conduct. I clarify why it is appropriate to focus on the Android App Distribution and Android In-App Billing Services markets separately, as opposed to the entire Android ecosystem, and address some of her other criticisms of the Android In-App Billing Services market in Section III.D.

- Moreover, as I discuss in more detail in Section III.D.2, I also find that her proposed relevant market is overly broad, "facilitation of digital content transactions."[36] By attempting to define the relevant product so broadly as to encompass the entire Android ecosystem, Dr. Tucker includes together products that are not substitutes (*e.g.*, distribution of non-Android apps on other mobile OSs, which cannot substitute for the Google Play Store), thereby shifting the focus on market definition away from the demand substitutes for Android App Distribution and the Android In-App Billing Services.

- In Section III.E, I explain that Dr. Tucker's narrower geographic market that is limited to the U.S., even if it is valid, does not address the evidence of Google's market power found in its dominance of the worldwide (excluding China) geographic market. I also describe in Section III.E that even assuming a narrower U.S. geographic market, my conclusions regarding Google's monopoly power from my Opening Report would still hold.

24.   I conclude that neither Dr. Tucker's criticisms of my analysis nor her conclusions with respect to the relevant markets at issue here change my opinion that Android App Distribution and Android In-App Billing Services are relevant antitrust markets for evaluating the effect of Google's challenged conduct. I review the most salient issues in Dr. Tucker's analysis below.

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[36] Tucker Report, ¶ 32, *see also* § III.B.1.

B.   My SSNIP Analysis is Robust to Criticism from Google's Consultants

25.   At the outset, it is important to emphasize that, in my Opening Report, I performed a quantitative SSNIP analysis based on published economic literature and the *U.S. Merger Guidelines* as well as using the data available in this case.[37] As explained in my Opening Report, my hypothetical monopolist test accounts for the two-sided nature of the Android App Distribution Market and its relationship with the Android In-App Billing Services Market.[38] Based on my analysis, I found that a hypothetical monopolist would find it profitable to raise price in the Android App Distribution Market.[39]

26.   The hypothetical monopolist test analyzes whether a proposed market is too narrow. According to the U.S. Horizontal Merger Guidelines the hypothetical monopolist test starts with products offered by the merging firms and asks whether a hypothetical monopolist of that product could profitably impose a SSNIP.[40] If the candidate product fails the test, then the market is too narrow.[41] But not all potential substitutes should be included, because if the market is defined too broadly it will understate a firm with market powers ability to raise prices or restrict output.[42] In my Opening Report, I applied an economic model grounded in the economic literature, used an elasticity of demand estimate for the Google Play Store from the published economics literature, and used data from Play transactions to model a SSNIP on a hypothetical monopolist of the Google Play Store.[43] My test found that a SSNIP was profitable if the hypothetical monopolist's marginal cost was any value greater than -$5.54, and since evidence indicates the hypothetical monopolist would face a positive marginal cost, I concluded that the

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[37] Rysman Opening Report, ¶¶ 117-123; U.S. Merger Guidelines, § 4.1.1 & § 4.1.3.

[38] Rysman Opening Report, ¶ 223.

[39] Rysman Opening Report, ¶ 231.

[40] U.S. Horizontal Merger Guidelines, § 4.0 and 4.1.1

[41] U.S. Horizontal Merger Guidelines, § 4.0 and 4.1.1

[42] U.S. Horizontal Merger Guidelines, § 4.1.1.

[43] Rysman Opening Report, ¶¶ 223-225 and Appendix F.

markets do not need to expand to include additional substitutes.[44] However, I also included preloading, sideloading, pre-installation, and other Android app stores in my market definition.[45]

27.   From the starting point of the product being "facilitation of digital transactions," Dr. Tucker points to numerous platforms that she believes are substitutes for the Google Play Store.[46] But this is an error that leads Dr. Tucker to understate market shares. The Guidelines explain that "the relative competitive significance of more distant substitutes is apt to be overstated by their share of sales," so the economists usually study "the smallest relevant market" in which the hypothetical monopolist can impose a SSNIP.[47] Thus, because I empirically demonstrate that a SSNIP would be profitable for a monopolist of the relevant markets the market is not too narrow, the analysis ends, and there is no reason to consider Dr. Tucker's proposed substitutes. Dr. Tucker's inclusion of these substitutes even past the point of a SSNIP leads her to underestimate Google's market power.

28.   Dr. Tucker criticizes the SSNIP analysis for three reasons. First, she claims that it "ignores the relevant economics of the outside good and does not account for the network effects which characterize the outside good. Second, Dr. Tucker argues that my SSNIP does not model the costs incurred by Google to facilitate unpaid transactions.[48] Third, she applies the model for a purpose it was not designed for, calculating what Google's service rate should be in the actual world, and claims both that "Google could profitably raise the service fee by more than 500%," and that the hypothetical monopolist would do so.[49] But this is a misapplication of the model used in my SSNIP analysis. Both Dr. Tucker and Dr. Leonard also criticize the estimate of the

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[44] Rysman Opening Report, ¶ 231.

[45] Rysman Opening report, ¶ 142 and Exhibit 18.

[46] *See e.g.* Tucker Report, §§ IV – V, and below in §§ III.C and III.D.

[47] U.S. Horizontal Merger Guidelines, § 4.1.1

[48] Tucker Report, Appendix H, ¶ 1.

[49] Tucker Report, Appendix H, ¶¶ 2 and 13. She also claims in Appendix H ¶ 3 that the fact that in my SSNIP analysis I considered whether a hypothetical monopolist of both Android App Distribution and Android In-App Billing Services on Android are in one broad market is evidence that the two markets should be combined. I discuss this in § III.D.1 of this report, and in V.C.5 of my Opening Report.

elasticity that I used.[50] I address each of these criticisms below, and explain why in my opinion the combined Android App Distribution and Android In-App Billing Services Market does not include any additional substitutes.[51]

1.   Modeling the Network Effects of the Outside Composite Good is Unnecessary for the SSNIP Analysis

29.   Dr. Tucker's first criticism is that my SSNIP analysis "ignores the relevant economics of the outside good and does not account for the network effects applying to the outside good."[52] Specifically, she claims that the composite outside good "includes iOS and gaming platforms" and that my model improperly "does not account for the network effects of these platforms," such that my SSNIP understates substitution between platforms.[53]

30.   First, it is important to note that my model does account for network effects between developers and consumers within the Android App Distribution and Android In-App Billing Services on Android markets,[54] and both developers and consumers respond to a change in the commission and discount rate that the hypothetical monopolist sets.[55] In order to understand Dr. Tucker's criticism, it is necessary to understand what products make up the "outside good." As I explained in my Opening Report the Android App Distribution Market contains, "The Google Play Store; other app stores that are available for Android … OEMs pre-installing their own apps or apps from third party developers on their Android smart mobile devices; and sideloading." The hypothetical monopolist owns all of these channels, so any substitution outside will be to app stores on other devices or the web, or simply consumers

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[50] Tucker Report, Appendix H ¶ 16. *See* VI.H.3 of this report for a discussion of Leonard's arguments related to this topic.

[51] Rysman Opening Report, ¶ 231.

[52] Tucker Report, Appendix H, ¶ 10.

[53] Tucker Report, Appendix H, ¶ 10.

[54] Rysman Opening Report, ¶¶ 219-220. Note that as explained in my Opening Report Android In-App Billing Services on Android market is one sided, but in considering whether the market is no broader than the combination of Android In-App Billing Services on Android and Android App Distribution. Rysman Opening Report, ¶¶ 267-270.

[55] Rysman Opening Report, Appendix F §§ II.B.1-2.

choosing not to spend on apps or developers choosing not to offer an app. As explained in my Opening Report, developers and consumers are unlikely to substitute to: app stores on PC's or gaming consoles, web apps, or app stores on other mobile OSs.[56] A portion of the consumer's substitution could be away from purchasing (*e.g.* keeping their money in their savings account or spending it on other goods besides apps), and a portion of the developer's substitution could be away from developing apps. For example, the increase in the average price of an app predicted by my SSNIP calculation is ███[57] According to Exhibit 21 of my Opening Report, the average price of an iOS device was nearly $1,000, and the average price of a new Android device was just over $200. The change in the price of apps due to a SSNIP customers would face is much smaller than if they switched mobile OS by purchasing a new smart mobile device.[58] As explained in my Opening Report, consumers are unlikely to incur the expense necessary to switch devices in the event of a SSNIP on prices charged in the Google Play Store.[59]

31.   Second, even assuming the entire decrease in spend from the SSNIP in the Android App Distribution Market were reflected in an equivalent increase in spending on the Apple App Store, that would only represent a small fraction of Apple's annual consumer spending on their App Store. The decreases in spending from the SSNIP predicted by my model is about ██████ over the period from August 16, 2016 through May 31, 2022, which on an annualized basis is about ██████ in 2020.[60] In contrast, in 2020, Dr. Tucker's own source estimates consumer spend on the Apple App Store in the U.S. to be ████████████████ ████████████████[61] Dr. Tucker's claim is that additional spending of this

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[56] Rysman Opening Report, §§ V.C.3. b), d), e), f), g) and h).

[57] Rysman Rebuttal Report Backup Production. This assumes conservatively that passthrough of changes of Google's commission rate to prices faced by consumers is 100%.

[58] Rysman Opening Report, Exhibit 21. *See also* Rysman Opening Report, ¶ 176 indicating estimated switching costs from the academic literature of $189 and $510.

[59] Rysman Opening Report, ¶¶ 163-174.

[60] Rysman Rebuttal Report Backup Production. To calculate the annualized figure for 2020, I take the percentage change in spend over the full period from August 16, 2016 through May 31, 2022, and apply that to spend on the Google Play store in 2020.

[61] "2021-2025 Mobile Market Forecast," Sensor Tower, 2021, available at https://go.sensortower.com/rs/351-RWH-315/images/Sensor-Tower-2021-2025-Market-Forecast.pdf." $21 billion is 567 times larger than $37 million.

magnitude on the Apple App Store would raise network effects on the App Store so much that it would spur further substitution from the Android App Distribution and Android In-App Billing Services markets to a different mobile OS and app store and make the SSNIP unprofitable (which I showed to be profitable for any positive marginal cost). I think it is unlikely that such a small shift in spend relative to existing spend would meaningfully change network effects, because it represents an increase in spend on the Apple App Store of only 0.18%. And that assumes all of the decreased spend would go to the Apple App Store only, and that there would be no reduction in overall app spending as a result of the SSNIP—both of which are unlikely to be true.[62] Given the small substitution away from the Play Store that would arise due to a SSNIP relative to the spend on other platforms and the fact that it would be distributed over numerous options (including simply not purchasing or not developing an app), I do not find it necessary for the purpose of a SSNIP to model network effects within the outside good. As explained further below, Dr. Tucker's premise for modeling network effects on these other platforms is that "data show that users switch from Android to iOS devices at high rates."[63] The data I cite in my Opening Report show that such switching levels are low.[64] In any event, evidence of switching in the actual world cannot be used as evidence of switching in the but-for world in the absence of the challenged conduct. Because actual world switching may simply result from Google charging supracompetitive prices, the Cellophane Fallacy infects Dr. Tucker's principal criticism of my SSNIP.

2. My SSNIP Analysis Results Are Robust to Accounting for Free Apps

32. Dr. Tucker's second criticism is that my SSNIP analysis does not account for free apps. Her concern is that "[i]f Google increases the service fee rates of paid app transactions, consumers may respond by increasing usage of free apps on Android and this may increase the

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[62] Dr. Tucker herself claims that in addition to the Apple Appstore, quantity would also be split among "the web, web apps, and gaming platforms." Although she does not recognize that overall quantity would be reduced, but that is clearly likely. *See* Tucker Report, Appendix H ¶ 10.

[63] Tucker Report, Appendix H ¶ 10.

[64] Rysman Opening Report, § V.C.4.

costs incurred by Google to facilitate unpaid transactions."[65] Dr. Tucker does not attempt to quantify this point, but it does not change my opinion for several reasons.[66]

33.　　　Dr. Tucker's concern seems to relate to an increase in the hypothetical monopolist's costs driven by a SSNIP leading to an increase in free transactions.[67] This concern appears not to be empirically relevant to my SSNIP analysis. There are three ways that usage of free apps could increase as a result of a SSNIP in the hypothetical monopolists commission and discount rates: (i) consumers could observe higher app prices and switch to free apps, (ii) paid apps could switch their monetization strategy and become free, or (iii) paid apps could exit the market which could push transactions from paid to free apps.[68] First, in my SSNIP calculation, I assume passthrough is 100%, but Dr. Leonard finds that passthrough is lower, he suggests 3%; in my variety damages I assume 0% passthrough.[69] If passthrough is lower than 100%, then consumers will not experience much of the price increase and would be less likely to switch to free apps. As I explain below, my SSNIP test is conservative because of this passthrough assumption.[70] Second, many apps are not likely to switch and become free or ad supported in response to a small change in the commission. In Section 112112 below, I show that developers usually choose a single monetization strategy and rarely switch strategies.

34.　　　For the increase in costs due to free transactions to make a SSNIP unprofitable it would need to outweigh the decrease in the cost of paid transactions that would result from the SSNIP. A simple extension of my SSNIP test from the prior report to include costs from free

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[65] Tucker Report, Appendix H ¶ 12.

[66] I note that I used an own-price elasticity estimate for the inside good (that is, an app from the Google Play Store) from the economics literature. I use the estimate in Ghose & Han (2014). Ghose and Han calculated Google Play Store elasticity in a sample that included free apps as well as paid apps. Ghose, Anindya and Sang Pil Han, "Estimating Demand for Mobile Applications in the New Economy," *Management Science*, Vol. 60, No. 6, 2014, pp. 1470-1488, at 1473 ("The apps in the daily app data consist of both top-400 free apps and top-400 paid apps from each app store.").

[67] Tucker Report, Appendix H ¶ 12.

[68] To the extent that Google or the hypothetical monopolist incurs fixed costs related to running a platform that facilitates what Dr. Tucker calls "free transactions," these fixed costs are not relevant to the hypothetical monopolist's incentive to raise the commission above the competitive level.

[69] Leonard Report, ¶ 79. Rysman Opening Report, ¶ 607.

[70] *See* § III.B.4 of this report.

transactions results in the following inequality, where if the hypothetical monopolist's marginal cost for paid transactions exceeds the term on the right it would be profitable to raise price by the SSNIP:[71]

$$C_{Paid} > Threshold + C_{Free} * Diversion_{Paid\ to\ Free}$$

35.   The term $Threshold$ is the same as the marginal cost threshold calculated in my prior report, which was ▮▮▮▮▮[72] The new term is the product of the cost of a free transaction and the diversion of transactions from paid to free. To be very conservative, I assume that free transactions increase by the same amount that paid transactions decline, then $Diversion_{Paid\ to\ Free} = 1$. Plugging in these two values and re-arranging, gives $C_{Free} - C_{Paid} <$ ▮▮▮▮▮ In my Opening Report, I provided evidence that the marginal cost of a paid transaction for the hypothetical monopolist is likely positive.[73] If C_{Paid} is positive,[74] then as long as the cost of a free transaction does not exceed the cost of a paid transaction by more than $5.54 the hypothetical monopolist would find it profitable to raise price. If the diversion from paid to free is not 100% then the cost of free transactions could exceed the cost of paid transactions by more than ▮▮▮▮ and the hypothetical monopolist would still be willing to raise price.

36.   Dr. Tucker does not explain why the variable costs associated with "free transactions" on the Google Play Store would be significant to the hypothetical monopolist (or significantly higher than that for paid transactions). ▮▮▮▮▮▮▮▮▮▮▮▮
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[71] *See* Appendix C of this report.
[72] Rysman Opening Report, ¶ 230.
[73] Rysman Opening Report, ¶¶ 230-231.
[74] *See* Rysman Opening Report, ¶ 230.
[75] Google Play P&L Data, GOOG-PLAY-010801682. ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮
▮▮▮▮▮▮▮▮▮▮▮▮▮▮ *See also* Google, "Play Finance Overview," November 2017, GOOG-PLAY-000613152.R-249.R, at 162.R ▮▮▮▮▮▮▮▮▮▮▮▮▮▮
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███████ Dr. Tucker also does not explain why the incentives of apps that are currently free would change in response to a SSNIP on paid transactions. For these reasons, my conclusions regarding the incentive of the hypothetical monopolist to raise prices by a SSNIP are not affected by so-called "free transactions."

3. Dr. Tucker Misapplies My SSNIP Analysis Model to Calculate the Profit Maximizing Commission

37.   Dr. Tucker uses the model that I applied in my SSNIP analysis to try to calculate the commission that Google or the hypothetical monopolist should charge developers.[76] As a result, she claims that my model implies that the hypothetical monopolist could profitably raise the commission to 99% from 15%.[77] By using the model to make predictions about commissions well above what is observed in the data (that Google and Apple both charge a 30% commission or lower for select developers and other Android App Stores also do not charge more than 30%),[78]Dr. Tucker inappropriately extrapolates beyond what the data allows. As I explain below, my model was not developed to calculate the optimal commission for either Google or the hypothetical monopolist and to do so would require considerations that are not necessary for the purpose of a hypothetical monopolist test (to determine whether it would be profitable for a hypothetical monopolist to raise the commission by a SSNIP from the competitive level). Even so, the prediction that a hypothetical monopolist with control over Google Play Store,

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[76] Tucker makes this claim about Google in ¶ 2 of Appendix H, but the calculations that support her claim described in ¶ 13 of Appendix H do not refer to Google, but instead to the hypothetical monopolist.

[77] Dr. Tucker says that my "model predicts that the hypothetical monopolist can profitably raise the service fee rate by more than 500% over the 15% service free rate" I use as the competitive benchmark. Tucker Report, Appendix H, ¶ 13. I do not take this to mean that the hypothetical monopolist could charge a commission of 500%. Rather, Dr. Tucker explains that the service fee rate could be profitable at 99% in my model, which is 500% greater than 15%, but only 300% greater than 30%, Google's prevailing commission for much of the damages period. Dr. Tucker also points out that at a 99% commission the price of apps would be more than ███. Her prediction of a ███ price is a misapplication of the model for the same reasons I explain this section that using the model to predict Google or the hypothetical monopolist would raise their commission to 99% is not appropriate. Tucker Report, Appendix H ¶ 13. Further, Dr. Tucker presents in Figure 1 of Appendix H in which she claims to display "Relationship Between App/In-app Content Price and Elasticity," I would like to clarify the terminology: the elasticity that she plots is not the usual elasticity of demand; this parameter represents the response of both consumers and developers in equilibrium to the change in the commission and I refer to it as $\epsilon_{Q,p}$.

[78] Rysman Opening Report, Exhibit 69; Tucker Report, Table 2.

sideloading, app pre-installation, and competing Android app stores would raise the commission above the approximately 30% used by Google may not be surprising.

      38.   There may be other constraints on Google's (or the hypothetical monopolist's) ability to raise the commission above 30%, but these may be less relevant to considering a hypothetical monopolist raising its commission from the competitive but-for commission:

- Dr. Tucker points to the possibility of network effects in the outside good in her criticism of my model.[79] As explained above, the changes in consumer spend and the number of apps predicted by the model after a SSNIP is small, and for the purposes of my SSNIP analysis I did not find it necessary to model these effects. ████████████████
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[79] Tucker Report, Appendix H ¶ 10.

[80] Tucker Report, Appendix H ¶ 13.

[81] Rysman Rebuttal Backup Production.

[82] Rysman Rebuttal Backup Production.

[83] Rysman Rebuttal Backup Production.

██████████████[84] In fact, the size of the decrease in spending predicted by the model is not proportional to the SSNIP, larger changes have disproportionally larger effects on consumer spend.[85] As discussed above, small changes in price are not likely to lead to any network effects in the outside good that would materially affect my SSNIP analysis. But for larger increases in the commission that lead to large changes in spend, network effects in the outside good may be important to model.

- Moreover, in the actual world there are competitors, like Samsung, with app stores in the Android App Distribution Market. It is not necessary to model the strategic reactions of these competitors in a hypothetical monopolist test (since the hypothetical monopolist controls these stores), however, to understand the incentives of a firm in the actual world to set its commissions one would need to account for these stores (and as discussed above any relevant network effects that might be relevant).

39.   Therefore, Dr. Tucker's calculations do not support the claim that Google or the hypothetical monopolist would want to raise the commission rate above 30%. The model I used for my SSNIP analysis was designed to capture the behavior of consumers and developers in the two markets and provide evidence on whether the two markets are a profitable monopoly. The goal of the SSNIP is to test whether a hypothetical monopolist would find it profitable to raise prices by a small amount, what an actual monopolist would do or what a firm with market power in the market has done are separate questions.

4.   My SSNIP Analysis Is Conservative

40.   In this section, I present three sensitivity analyses for the SSNIP analysis in my Opening Report. First, I calculate without using the detailed model of consumer demand and app developer entry and exit what the critical responsiveness of quantity in the Android App

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[84] Rysman Rebuttal Backup Production.

[85] A SSNIP of 100% (changing the commission from 15% to 30%) leads spend to decrease by about $1.9 billion over the entire period. As the size of the SSNIP (or equivalently the commission) considered by Dr. Tucker increases, consumer spend in the Android App Distribution and Android In-App Billing Service markets decreases. *See* Rysman Rebuttal Backup Production.

Distribution and Android In-App Billing Services markets would need to be such that if the actual responsiveness is lower than this critical value a SSNIP will be profitable. Second, I investigate the sensitivity of my SSNIP analysis to using the elasticity that I estimated in my regression instead of the elasticity from Ghose and Han (2014). Finally, I investigate what the effect of assuming that passthrough is less than 100% would be on the SSNIP analysis. Based on these calculations, I find that the SSNIP analysis in my Opening Report was conservative.

41.   First, I revisit the SSNIP analysis in my Opening Report to examine the incentives of the hypothetical monopolist without relying on a specific model and based on this I find it likely that the hypothetical monopolist would find a SSNIP profitable. The equation for the marginal cost threshold above which the hypothetical monopolist would raise price is:[86]

$$C \geq \frac{\epsilon_{Q,p}(1.1\,\tau^* - 0.9t_B^*)p^{**} - \frac{[(1.1\tau^* - 0.9t_B^*)p^{**} - (\tau^* - t_B^*)p^*]p^*}{p^{**} - p^*}}{\epsilon_{Q,p}}$$

42.   The right-hand side of this inequality is a function of three things, i) $\epsilon_{Q,p}$ how much the quantity of transactions changes when the average app prices change in response to a change in the commission and the discount rate, ii) p^{**} and p^* and therefore the change in price expected given a change in the commission and the discount rate, and iii) the competitive commission and discount rate. Given the same competitive commission and discount rate used in my Opening Report, if I make an assumption about how much p^{**} will increase after the SSNIP – i.e., if I make an assumption about passthrough, then I can calculate the threshold marginal cost as a function of $\epsilon_{Q,p}$. Further, if I estimate Google's marginal cost, then I can calculate a critical value of $\epsilon_{Q,p}$ such that for any $\epsilon_{Q,p}$ less than that value the hypothetical monopolist would find it profitable to raise price. ████████████████████████████

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[86] Rysman Opening Report, Appendix F E.15, *see also* ¶ 225.

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43.   Overall, based on the full set of evidence available in this case, the actual value of $\epsilon_{Q,p}$ that a hypothetical monopolist would face when considering a SSNIP would be less than the critical value ███.[88] This is because the hypothetical monopolist would control the Google Play Store and not face competition from sideloading, pre-installed apps, or alternative Android app stores. Consumers and developers, as discussed elsewhere in this report and in my Opening Report, would be unlikely to substitute to app stores on other mobile devices or other channels of distribution.[89] The fact that Google currently charges a commission of about 30% while facing competition from sideloading, pre-installed apps, or alternative Android app stores indicates that a hypothetical monopolist would be able to raise its commission above a much lower competitive rate of 15%. Put another way, if the actual responsiveness of transactions to a change in app

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███████████████████ July 2, 2021, GOOG-PLAY-007819776-064, at 861), and multiplying this by total consumer spend in 2021 calculated from the Google Transactions data██████████████████████████

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███████████ (*see* Google, ██████████████████" September 9, 2014, GOOG-PLAY-003764714.R-746.R, at 715.R-720.R.) If the sensitivity of app price to the commission is lower or the actual marginal cost is higher, then this critical threshold of $\epsilon_{Q,p}$ will be larger making it more likely a SSNIP will be profitable. *See* Rysman Rebuttal Report Backup Production.

[88] *See* Rysman Opening Report, § V.C. and V.D on market definition.

[89] *See* III.C of this report. *See also* Rysman Opening Report § V.

prices was not less than ▮ this calculation indicates that the hypothetical monopolist would likely not be willing to raise its commission to the level that Google actually has charged.[90]

44.   Dr. Tucker also states that instead of relying on the estimate of price elasticity of demand of ▮ from my regressions, I used an estimate of price elasticity that was "twice as large" from Ghose and Han (2014), ▮.[91] If Dr. Tucker is suggesting that I should use ▮ in my SSNIP calculation, then she does not understand my model. Using the higher elasticity is conservative, because it implies that consumers value variety and spending on the on apps less than at the lower elasticity (they are more willing to substitute). Re-calculating the marginal cost threshold that I calculated in my Opening Report of ▮ using the estimated price elasticity of demand from my regressions gives ▮▮▮▮[92]▮▮▮▮

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▮▮▮ than I calculated in my Opening Report, the hypothetical monopolist would find a SSNIP profitable.

45.   Dr. Leonard claims that the sensitivity of app prices to Google's commission is less than 100%.[93] As with my damages model, my SSNIP calculation is flexible enough to accommodate alternative passthrough rates.[94] However, using a lower sensitivity has the effect of increasing the incentive of the hypothetical monopolist to raise prices above the but-for competitive level because consumers will not feel the full effect of the change. To demonstrate that it is conservative for my SSNIP calculation to assume 100% sensitivity of prices to the commission, I have re-calculated the marginal cost threshold that I calculated in my Opening Report of ▮ using the level of sensitivity suggested by Dr. Leonard of ▮ and ▮

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▮▮▮ the assumptions described above for the hypothetical monopolist's marginal cost and the passthrough rate). *See* Rysman Rebuttal Report Backup Production.

[91] Tucker Report, Appendix H ¶ 16.

[92] Rysman Rebuttal Report Backup Production.

[93] *See e.g.* Leonard Report, ¶ 79.

[94] Rysman Opening Report, ¶¶ 605-607.

█████████████████████[95] I also re-calculated the threshold using Dr. Singer's estimate that the sensitivity is █████████████████████████.[96] ████████████████████

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5.   *Dr. Tucker's Criticisms of My Regression Analysis Are Overstated*

46.   Dr. Tucker criticizes the regression model that I use to provide evidence about the likely size of apps' own price elasticity of demand.[97] This elasticity is used in the calculation of the welfare effects through increased varieties, total welfare effects, and associated damages.[98] Dr. Tucker makes two criticisms: i) that because taxes are not salient, my instrument may understate elasticity of demand, and ii) that my use of data aggregated across states is not appropriate.[99] I address these criticisms more directly below, but regardless of Dr. Tucker's criticisms of my regression, in fact I use the own price elasticity of demand estimated by Ghose and Han (2014), which, as I explain below, corroborates my findings and uses alternative methods that avoid Dr. Tucker's criticisms.

47.   My regression model that estimates the own-price elasticity is a regression of the log of the quantity of items (apps or in-app content) purchased on the log of prices, in which I control for app, time, and app purchase type.[100] A standard regression may be problematic because prices are endogenous, and this can be corrected for using an instrumental variable regression.[101] Prices are endogenous in this setting to the extent that there are factors not included in the controls that would affect the quantity of the app or in-app content consumed by

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[95] Leonard Report, ¶ 79. Rysman Rebuttal Report Backup Production.

[96] Leonard Report, ¶ 79. Rysman Rebuttal Report Backup Production

[97] Tucker Report, Appendix F.

[98] Rysman Opening Report, ¶ 576.

[99] Tucker Report, Appendix F ¶ 6 & ¶ 12.

[100] Rysman Opening Report, ¶ 576.

[101] Rysman Opening Report, ¶ 576 and sources cited therein.

users, and correlate with the price set by the developer for their app or in-app content. To address this issue, instrumental variables regression requires identifying a variable that shifts the price that users face but does not affect the quantity consumed by users except through its effect on price. In my Opening Report, I used the tax rate as the instrument for price because it will affect the quantity that consumers purchase only through the price they pay after tax.

48.   Dr. Tucker claims that because tax rates are not "salient" using the tax rate as an instrument may understate elasticity of demand.[102] Taxes are not salient when consumers do not fully incorporate the tax into their decision making when deciding whether or not to purchase an item. Dr. Tucker cites to a Google page to support the statement that "In the context of app purchases, as with other sales taxes in the United States, tax rates are not salient because they are not included on the price tag," but to the contrary this Google page states "You'll always see tax that will be charged on the checkout screen before completing your purchase. The way Google Play calculates and handles tax depends on the type of content."[103]

49.   Dr. Tucker provides an example of purchasing Robux (a virtual currency for in-app items) from Roblox using Google Play.[104] She states that if she purchased ▮▮▮▮ of Robux she "would not actually know that it is going to really cost me ▮▮▮▮ (including taxes) at the point I pressed the buy button." However, as shown in Exhibit 1, the information on the tax is just a single tap away (clicking on the "+ tax" in the red box leads from the page on the left to the page on the right).

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[102] Tucker Report, Appendix F ¶ 6. Her point about the salience of the tax rate is not about whether the instrument solves the classic endogeneity concern in demand estimation that prices are endogenous because of common factors shifting supply and demand. Rather it is about exactly what the instrument identifies. In the spirit of the local average treatment effect, the estimate resulting from a valid instrument still depends on how responsive agents are to the instrument. *See* Angrist, Joshua D. and Guido W. Imbens, "Identification and Estimation of Local Average Treatment Effects," *Econometrica,* Vol. 62, No. 2, March 1994, pp. 467-475 at p. 470 ("The local average treatment effect is analogous to a regression coefficient estimated linear models with individual effects using panel data. In models with fixed effects, the data are only informative about the impact of binary regressors on individuals for whom the value of the regressor changes over the period of observation. Under Theorem 1 the treatment effect identified is an average for those who can be induced to change participation status by a change in the instrument.")

[103] Google, "Tax information for Google Play purchases," available at https://support.google.com/googleplay/answer/2850368.

[104] Tucker Report, Appendix F ¶ 10 and Figure 1.

Exhibit 1
Tax Information When Purchasing Robux
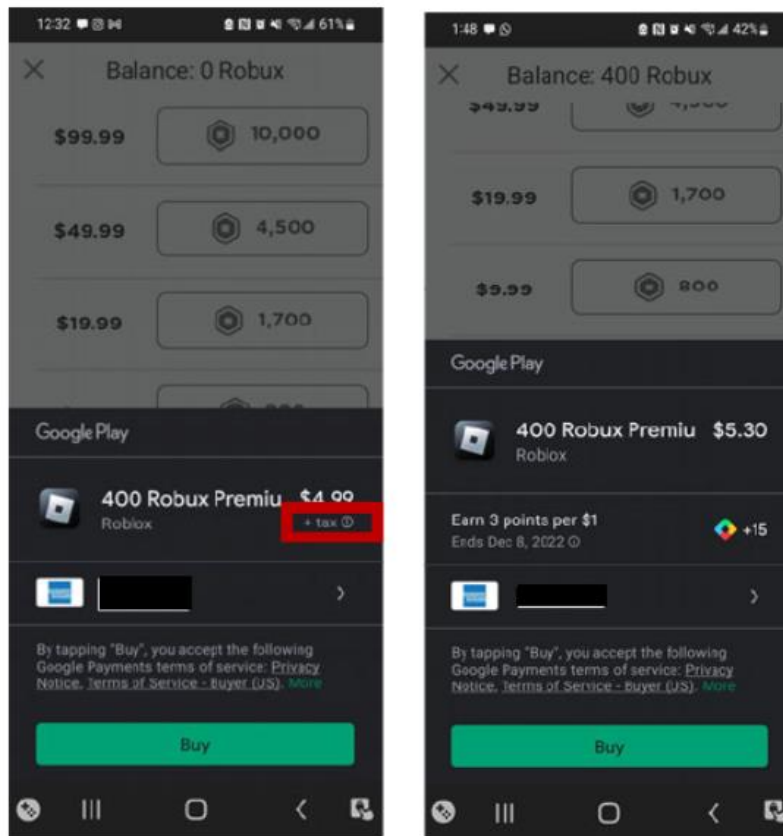
50.   Dr. Tucker also quotes from the academic literature to claim that taxes are not salient.[105] The paper from which this claim originates studies the salience of taxes in a grocery store and for beer consumption and finds evidence that consumers in the U.S. do not perfectly account for sales taxes.[106] However, it is possible that in the setting of the Play Store taxes may

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[105] Tucker Report, Appendix F ¶ 9 citing to Zoutman et al. (2018) who are in turn citing to Chetty, Looney, and Kroft (2009).

[106] Chetty, Raj, Adam Looney, and Kory Kroft, "Salience and Taxation: Theory and Evidence," American Economic Review, no. 99, 2009, pp. 1145-1177, at p. 1145 and 1146. ("First, using a field experiment in a grocery store, we find that posting tax-inclusive price tags reduces demand by 8 percent. Second, increases in taxes included in posted prices reduce alcohol consumption more than increases in taxes applied at the register;" "Exploiting state-level changes in these two tax rates between 1970 and 2003 coupled with annual data on total beer consumption by state, we find that increase in the excise tax reduce beer consumption by an order of magnitude more than similar increases in the sales tax.")

be more salient than in grocery stores or for beer purchases. The Google Play interface reminds consumers that there is a tax that they should account for on their purchase, while they still have complete freedom to abandon the transaction.

51.   Regardless, the use of the tax rates provides an estimate of the elasticity of demand of 1.736 is not dissimilar to what Ghose and Han (2014) estimate of 3.731, and this consistency shows that the instrument I used is working as expected. Ghose and Han use a different set of instruments (*i.e.* not the sales tax rate) that are standard in the industrial organization literature, but which rely on the ability to observe in the data different information about the apps than was used for my regression.[107] Even if Dr. Tucker is correct that because taxes may not be perfectly salient "the resulting estimate of the price elasticity of demand will appear less elastic,"[108] I conservatively use the estimate of the elasticity from the published academic literature that is not subject to her criticisms in my SSNIP analysis and damages calculation.[109]

52.   Dr. Tucker also claims that my use of data aggregated across states is problematic.[110] She says this is because "changes in the composition of purchases across states would wrongfully introduce variation in prices and tax rates; in the presence of varied state tax policies, shifts in demand across states would wrongfully be interpreted as shifts in tax rates even when tax rates did not, in fact, change." Aggregation across states is conceptually appropriate in this setting because prices are set by apps at the national level and do not vary by state.

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[107] Ghose and Han (2014) at p. 1478 & 1479 ("Specifically, following BLP, we use the observed app characteristics (excluding price), the sums of the values of the same characteristics of apps offered by the same app developer, and the sums of the values of the same characteristics of apps offered by other app developers;" "Second, we use the average price of the same-category apps by the "same app developer" in the other app store and the price of the same app by the "same app developer" in the other app store as instruments for price. This approach is similar in spirit to Hausman's (1997) approach."). *See* Berry, S., J. Levinsohn, and A. Pakes, "Automobile prices in market equilibrium," *Econometrica*, Vol. 63, No. 4, July 1995, pp. 841–890 (hereafter "BLP (1995)"), pp. 861; Hausman, Jerry, "Valuation of New Goods under Perfect and Imperfect Competition," in The Economics of New Goods, Ed. Timothy F. Bresnahan and Robert J. Gordon National Bureau of Economic Research and the *University of Chicago Press,* 1996, pp. 207-248, at 219.

[108] Tucker Report, Appendix F ¶ 9.

[109] Rysman Opening Report, ¶ 580 and Appendix F ¶ 77.

[110] Tucker Report, Appendix F ¶ 15.

Aggregation is also standard in the economics literature and has been done in many applications.[111] Further, the regression includes app and month fixed effects, so these shifts in spend across states would need to be within the same app overtime and specific to the app such that they are not captured by controlling for the month. This would be particularly problematic if apps engaged in marketing campaigns aimed at only some states and not others, but Dr. Tucker does not provide evidence of this being empirically relevant.[112] Even if Dr. Tucker's concern has some merit, as noted above, I conservatively use the estimate of the elasticity from the literature in my damages and SSNIP calculations.

53.   It is notable that although Google experts criticize my estimates of the elasticity of demand for apps, they do not provide any evidence of their own on this important issue. The fact that Google experts provide no evidence that elasticity is higher than the numbers I use, which are corroborated in the literature, and this contributes to my confidence in my results.

C.   Dr. Tucker's Purported Competing Platforms Do Not Constrain the Hypothetical Android App Distribution Monopolist

54.   Before addressing Dr. Tucker's specific criticisms, it is helpful to review the role of a quantitative SSNIP analysis in implementing the hypothetical monopolist test. As I noted in my Opening Report, the *U.S. Merger Guidelines* are clear that, even when the evidence is not available to perform the test quantitatively, the conceptual framework of the hypothetical monopolist test can still be used for market definition.[113] If I had been unable for some reason

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[111] Hendry, David F., "The Methodology of Empirical Econometric Modeling: Applied Econometrics Through the Looking-Glass," in Palgrave Handbook of Econometrics, Volume 2, Applied Econometrics, Eds. T.C. Mills et al, pp. 4-57, at p. 22 ("Almost all economic data are aggregated in some way, implicitly discarding the disaggregates"). For mainstream demand estimation research using aggregate data, *see* Deaton, Angus and John Muellbauer, "An Almost Ideal Demand System," The American Economic Review, June 1980, Vol. 70, No. 3, pp 312-326; and BLP (1995).

[112] Note that app prices appear to be set at the country level. Google, "Set up your app's prices," available at https://support.google.com/googleplay/android-developer/answer/6334373?hl=en#:~:text=How%20to%20Set%20Up%20Pricing%20for%20a%20Paid,base%20for%20calculating%20market-specific%20prices.%20...%20See%20More. ("You can set your app as free or paid, update your app's pricing universally or per country, and use pricing templates to simplify pricing for your apps in Play Console.").

[113] Rysman Opening Report, ¶ 121 citing to U.S. Merger Guidelines, § 4.1.3.

(*e.g.,* data limitations) to perform a quantitative SSNIP analysis as part of the hypothetical monopolist test, I would still have reached the conclusion that Android App Distribution and Android In-App Billing Services are relevant antitrust markets based on the evidence available in this case, which I presented in my Opening Report.[114] Moreover, economists do not view market definition as necessary to establishing market power if direct evidence of market power is available, as it is in this case.[115] I discuss the problems with Dr. Tucker's own qualitative analysis below.

1. Dr. Tucker's Analysis of Apple and Google Fails to Show Apple Constrains Google in the Relevant Market

55. Dr. Tucker argues that the relevant market should reflect competitive constraints imposed by Apple on Google.[116] Dr. Tucker's conclusion relies on evidence including:

- The claimed relative ease of switching between Apple and Android;[117]

- Documents, testimony, and marketing material she interprets incorrectly as showing the Android and iOS ecosystems compete;[118]

- Data she claims shows switching by users between Android and iOS; [119]

- The claimed similarity in price and features between the Apple App Store and Google Play Store;[120] and

- The claim that Apple and Google compete to attract developers.[121]

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[114] Rysman Opening Report, V.C.1-4, V.C.6., and V.D.

[115] On the necessity of market definition, *see* references in Rysman Opening Report, footnote 292. I discuss direct evidence of Google's market power in Rysman Opening Report, §§ VI.A.1- 2 and VI.C.1.

[116] Tucker Report, § IV.

[117] Tucker Report, § IV.A.4.

[118] Tucker Report, §§ IV.A.1-IV.A.2.

[119] Tucker Report, § IV.A.3.

[120] Tucker Report, §§ IV.C.1-IV.C.2.

[121] Tucker Report, § IV.C.3.

56.   However, Dr. Tucker's evidence falls short of showing users would substitute in significant numbers if a hypothetical monopolist imposed a SSNIP on the relevant market. Dr. Tucker also ignores important lessons from the Cellophane Fallacy and fails to consider whether substitution (or indicators of competition) between Apple and Google is a sign of competition or a profit-maximizing monopolist raising price (or degrading quality) to a point where even inferior goods become substitutes. I also note that Dr. Gentzkow's evidence on Android and iOS pricing corroborates my opinion that the Apple App Store does not constrain the Google Play Store. I discuss each of these main pieces of evidence in detail in the sections below.

    a)   Evidence of User Switching and Multi-homing between Android and iOS Does Not Indicate Apple Participates in the Relevant Markets

57.   As explained above, Dr. Tucker incorrectly views transactions on Apple's iOS as belonging in the relevant antitrust markets for this case. She presents evidence related to Google and Apple's marketing efforts to get consumers to switch between Android and iOS devices, as well as some empirical evidence of switching to support her claim. I address this evidence in sequence below. Overall, I find this evidence does not show that Apple is in the relevant market, and it falls short of showing that Apple constrains Google's market power in Android App Distribution and Android In-App Billing Services.

58.   Dr. Tucker provides a number of different data points related to switching between Android and iOS. Before I address some of these in detail, there are three critical problems with her switching analysis.

59.   First, Dr. Tucker's analysis of switching is relevant to, at most, one side of the two-sided Android App Distribution Market I propose. Evidence of consumers switching between Apple and Android smart mobile devices says very little about whether developers switch between the platforms in the same way. In other words, because Android and Apple users of smart mobile devices tend not to overlap, and because the developer's incentives are to maximize profits, the developer is incentivized to offer an Android app and an iOS app, provided

that the engineering costs of offering both are lower than the expected revenues from doing so.[122] Participating in multiple platforms is known as multi-homing. Because developers are incentivized to multi-home, they do not switch between serving Android and iOS users; because, even if those users switch, the users tend to single-home with one smart mobile device. If developers want to reach those consumers, they must produce an app for that OS. There is no alternative method to reach those consumers. If users were willing to switch ecosystems in response to changes in the price of apps, then developers who have developed apps on both platforms might be able to steer them to iOS or Android and avoid the costs of developing for both platforms. I have not found evidence that developers do this, and Dr. Tucker proposes none.

60.   Second the level of switching between Apple and Android smart mobile devices is, at best, only indirectly relevant to the Android App Distribution Market. Users can switch between ecosystems for all kinds of reasons independent from the price or variety of apps, but the relevant question is whether users would switch between Apple and Android devices in sufficient numbers *in response to a SSNIP by a hypothetical monopolist* in the Android App Distribution Market or the Android In-App Billing Services Market.[123] Dr. Tucker's evidence

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[122] Rysman Opening Report, ¶¶ 45-46.

[123] Dr. Tucker appears to agree: "The relevant question for determining whether the Apple App Store acts as a competitive constraint on the Google Play Store is not whether a substantial number of users switch to iOS devices. Rather, the question is whether a substantial number of users would switch to iOS if the price of the Google Play store increased or its quality decreased relative to the price or quality that would prevail absent monopoly power. Given that the Google Play store is free for most users, it is important to consider whether a substantial number of users would switch to iOS if the Google Play store fell behind the Apple App Store in providing a quality experience for users because Google cut back on efforts to keep the Google Play store competitive. If the answer is yes, then Google has strong incentives to invest in keeping the Google Play store competitive with the Apple App Store, indicating that the Apple App Store acts as a competitive constraint on the Google Play store." What Dr. Tucker fails to recognize is that, for the purposes of market definition, what is relevant is a change in quality equivalent to a small (typically 5% to 10%) change in the commission and discount rate offered by a hypothetical monopolist in the relevant markets. Tucker Report, ¶ 172.

that users switch smart mobile devices to use different app stores,[124] such as users who choose to multi-home (*i.e.*, own both types of devices), is limited.

61.   Third, Dr. Tucker falls victim to the well-known Cellophane fallacy. As explained in my Opening Report, the Cellophane fallacy is where a profit-maximizing monopolist may have already increased the price to a point where even goods that would normally be distant substitutes (that would be outside a relevant market under competitive conditions) become substitutes.[125] The genesis of the "Cellophane fallacy" is a case where DuPont (the sole manufacturer of cellophane) increased the price of cellophane to a point where other flexible wrapping materials (*e.g.*, aluminum foil) became substitutes. DuPont argued that this substitution / switching resulting from a SSNIP proved these inferior goods were in the market, but DuPont's analysis did not conduct the SSNIP at the competitive level. Instead, it used the prevailing (potentially anticompetitive) market price, and therefore risked defining the market too broadly to be useful.

62.   Dr. Tucker's analysis similarly risks defining the market too broadly to be useful by just *assuming* that marginal substitution toward Apple and competition from other Android app stores are equivalent so far as Google is concerned – which is also her conclusion. But I have performed an economic analysis that shows that this proposition is wrong, which is unsurprising because it ignores the basic differences between a developer or consumer choosing iOS and choosing a competing Android app store. The fact that some marginal substitution to iOS occurs in a world in which Google has virtually complete control of Android app distribution is, standing alone, uninformative, because some substitution can still happen at the monopoly price or at quality or variety below the competitive level. Dr. Tucker has not established that this

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[124] For example, Dr. Tucker describes Android's share decreasing while iOS's share has increased recently as evidence of switching, but she does not explain why these changes in overall shares in a different market are evidence users would switch to iOS in response to a small price increase in Android App Distribution or In-App Billing Services. She also describes competition for new users but provides no analysis of the features on which new users base their phone choice; whether they choose based on the perceived price or quality of Android App Distribution and In-App Billing Services, or other features. *See* Tucker Report, ¶¶ 165-166.

[125] Rysman Opening Report, ¶ 119 and footnote 297. See, also "Appeal from the United States District Court for the District of Delaware," United States v. E.I. du Pont de Nemours & Co., Case No. 351 U.S. 377, 1956.

substitution is due to app store pricing and, as I have discussed elsewhere, there is good reason to think it is not. However, to the extent it does, evidence of substitution from Google and to Apple may be nothing more than substitution away from monopoly-level quality-adjusted Google prices.

63.   I now turn to showing that Dr. Tucker's empirical analysis of switching rates does not suggest Apple participates in the relevant markets.

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███████████████████████████████████████[126] Dr. Tucker then argues that "users can choose whether to purchase digital content in the Apple App Store on their iPad and use it on their Android smartphone or purchase digital content via the Google Play store on their Android smartphone and use it on their iPad, creating direct competition between the two stores and ecosystems." ██

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███████ Dr. Tucker also does not provide any evidence that users are systematically using an iPad to purchase digital content that they then use on their Android smart mobile device or would be willing to do so in sufficient manner to constrain a hypothetical monopolist or Google. ████████

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126 Tucker Report, ¶ 164.

127 *See e.g.,* Google, ███████████████████ November 2016, GOOG-PLAY-000092281.R-330.R at 286.R

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████ The presence of users who may not be willing to switch is further evidence that, for app developers, iOS and Android are complements rather than substitutes. Therefore, including iOS in the relevant markets would not be appropriate.[130]

66.   Second, in my Opening Report, I showed that 80% of users only have one smartphone.[131] Dr. Tucker's evidence that some users multi-home by purchasing an Android smartphone and an iPad does not address this tendency by consumers to single-home when it comes to their smartphone. ██████████████████████████████████

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67.   Third, Dr. Tucker presents several different switching rates between iOS and Android in Table 2 and Table 8 of her report. These switching rates are not dissimilar to the rates cited in my Opening Report and do not materially alter my opinions for the reasons stated above.

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[128] According to Dr. Tucker, ████████████████████████████████████
████████████████████████████████████ *See* Tucker Report, ¶ 164.

[129] Rysman Opening Report, ¶ 170 (citing to Google, ████████████████████████████ September 2020, GOOG-PLAY-011640881-906, at 882.) *See* Rysman Opening Report ¶¶ 160-174, ████████████████
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[130] Rysman Opening Report, § V.C.4.

[131] Rysman Opening Report, ¶ 330 (citing to CMA Final Report on Mobile Ecosystems, ¶ 3.39 and footnote 85).

[132] *See e.g.,* Google, ██████████████████" November 2016, GOOG-PLAY-000092281.R-330.R at 286.R
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████ In Table 8, Dr. Tucker further disaggregates the rate of switching by the price band of the user's current phone. ███

██[134] But this may simply reflect the fact that, having switched from Android, a user likely switched to a more expensive iPhone; this does not mean that those with an expensive Android phone are likely to switch to iOS, as Dr. Tucker implies.[135]

68.   Fourth, Dr. Tucker compares switching between iOS and Android to some estimates of the rate of switching in orange juice, liquor, and ketchup.[136] Starting from the premise that these industries are not characterized by high switching costs, she concludes that, because these products have similar switching rates as iOS and Android, iOS and Android must also not have high switching costs.[137]At any rate, these comparisons are not directly useful for understanding switching rates or costs. What is relevant is the extent that users would switch in response to a SSNIP in the relevant markets, which here are Android App Distribution and In-App Billing Services. Therefore, the most relevant comparison related to orange juice would be the rate that consumers would switch grocery stores if the price of orange juice at one store increased. Also, these comparison products are purchased much more frequently than phones as they are perishable and they deplete as they are consumed. For example, the paper that Dr. Tucker cites on orange juice records 9.37 purchases by the average household in their sample

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[133] Rysman Opening Report, ¶ 187 (citing to Google, ██████████████████ November 2018, GOOG-PLAY-004556784.R-813.R, at 79██████████████████████ ████████████████████
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███████████████████████████████████████ *See* Rysman Opening Report, ¶ 187 (citing to Google, ██████████████████ September 2020, GOOG-PLAY-011640881, at 882 and Google, ██████████████████ January 2021, GOOG-DOJ-27418506-510, at 507.).

[134] Tucker Report, Table 8.

[135] Tucker Report, ¶ 359.

[136] Tucker Report, ¶ 173.

[137] Tucker states that "Economists generally do not consider these products to have large switching costs because it is easy and cheap for consumers to choose a new brand each time they go to the grocery store," but provides no citation. Tucker Report, ¶ 173.

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over 3 years.[138] However, a report from Kantar WorldPanel indicated that phones are purchased significantly less frequently: "[i]n 2016, American smartphone owners used their phones for 22.7 months on average before upgrading" and "[b]y 2018, that number had increased to 24.7" and smartphones do not deplete as they are consumed.[139] Switching could naturally be higher over the same time period for these staples because there are so many more opportunities to switch given the short life cycle of the product. A smartphone purchase is also a much more significant decision for a consumer than the choice of condiments given that smartphones are far more expensive.[140] Dr. Tucker ignores these obvious, real-world differences in her comparisons. Consequently, these cross-industry comparisons of switching rates are irrelevant and, therefore, do not affect my opinions.

69.   In my Opening Report, I provided evidence that switching between Android and iOS would not be sufficient to discipline a hypothetical monopolist in Android App Distribution or In-App Billing Services.[141] As stated above, what is relevant is switching that would occur in response to a small but significant increase in commission above the competitive level by a hypothetical monopolist in my proposed markets. ███████████████████████

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[138] If households make about 3 (=9.37/3) purchases in a year, and switch with a probability of 14%, then the probability of switching at least once in a year is 36% (= 1-(1-0.14)^3). Dubé, Jean-Pierre, Günter J. Hitsch, and Peter E. Rossi, "Do Switching Costs Make Markets Less Competitive?," Working Paper, March 2008, available at https://www.semanticscholar.org/paper/Do-Switching-Costs-Make-Markets-Less-Competitive-Dub%C3%A9-Hitsch/33a075aba4d2fcfcb3b4b0a5f9fdfd4bd5a4a1dc, pp. 1-49, at p. 18. Similarly, the time between ketchup purchases was 9.6 weeks, *see* Ailawadi, Kusum L., Karen Gedenk, Christian Lutzky, and Scott A. Neslin, "Decomposition of the Sales Impact of Promotion-Induced Stockpiling," Journal of Marketing Research, Vol. 44, No. 3, 2007, pp. 450-467, at p. 454. The study that she cites on Liquor estimates brand retention based on the correlation of a brands sales in the current year with the same brand's share in the previous year. This is not a switching rate as there may be many reasons why shares are correlated overtime, and the study only controls for advertising spending and only in some models controls for price. The study, published in 1969, does not seem relevant to switching rates between Android and iOS devices. *See* Simon, Julian L., "The Effect of Advertising on Liquor Brand Sales," Journal of Marketing Research, Vol. 6, 1969, pp. 301-313, at pp. 303-304.

[139] Ng, Abigail, "Smartphone Users Are Waiting Longer Before Upgrading – Here's Why," CNBC, May 16, 2019, available at https://www.cnbc.com/2019/05/17/smartphone-users-are-waiting-longer-before-upgrading-heres-why.html.

[140] The observation that some goods have lower switching rates than smart phones also does not provide evidence that the level of switching or switching costs in smart mobile devices is sufficient to constrain pricing in the relevant markets.

[141] *See* Rysman Opening Report, § V.C.4.

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███[142] According to Exhibit 21 of my Opening Report, the average price of an iOS device in 2021 was nearly $1,000, and a new Android device in 2021 was on average just over $200. While some users may switch after the SSNIP, there are clearly many other attributes that must factor into the decision to buy a new smart mobile device.

70.   Dr. Tucker describes Google and Apple's marketing efforts that aim to convince users that switching is easy and describes some recent improvements in technology that have made switching easier.[143] First, the existence of these efforts and the investments in developing these technologies indicate that there are switching costs that need to be overcome and would be relevant to users choosing to purchase a new device. Second, while the utility apps that facilitate switching may address switching costs due to data loss or time necessary to move devices, there are additional costs, like those associated with learning a new operating system, that still remain.[144]

71.   Additionally, Dr. Tucker indicates that between 2018 and 2021, "several million adults became new smartphone users" who chose Android or Apple for the first time.[145] I give similar figures in my Opening Report.[146] Similarly, Dr. Tucker points to data showing that half of U.S. children under 11 become new smartphone owners each year.[147] I likewise gave similar estimates in my Opening Report.[148] To the extent these children are not the actual buyer of their smartphone but their parents are, it is possible that parents are buying phones from the ecosystem they prefer and have already adopted. ████████████████████████████████

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[142] Rysman Opening Report, Exhibit 28. This is an increase of $0.14.

[143] Tucker Report, §§ IV.A.2 and IV.A.4

[144] See Rysman Opening Report, § V.C.4, where I explain these switching costs in greater detail.

[145] Tucker Report, ¶ 166.

[146] Rysman Opening Report, ¶ 162.

[147] Tucker Report, ¶ 166.

[148] Rysman Opening Report, ¶ 162.

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> b)   The Fact that Apple and Google View Each Other As Competitors
> Does Not Justify Broadening the Relevant Markets

72.   Dr. Tucker presents evidence that Google views Apple as a competitor of the
Android ecosystem, that Apple and Google marketing materials show iOS and Android compete,
and that Apple views Android as a competitor.[150] However, this case is about conduct that affects
Android App Distribution and In-App Billing Services. Therefore, competition between Android
and iOS is only relevant to the extent consumers would be willing to substitute to iOS in
response to changes in the Android App Distribution or Android In-App Billing Services
markets. Setting that aside, evidence that firms view each other as competitors in some sense is
not evidence that they are in the same relevant antitrust market. This is because if one or both
firms has exercised significant market power and if there is substitution between the two firms'
products, they may view each other as competitors. But they would not view each other in this
way if one or both of the firms faced competition, and therefore substitution to other products
that are closer substitutes.[151] In other words Dr. Tucker's analysis suffers from the Cellophane
Fallacy. It may also simply be that executives are responsible for considering distant threats and
new business strategies to pursue, and therefore are not thinking about the specific forces of
demand substitution relevant to defining a market.[152]

> c)   Similarity of Pricing and Features Does Not Suggest a Common
> Market Here Because, for Developers, Android and Apple App
> Distribution are Complements, Not Substitutes

73.   Dr. Tucker cites several similarities between the Google Play Store and the App
Store as evidence that Apple and Google compete.[153] She shows that they offer similar

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[149] Rysman Opening Report, ¶ 174.

[150] Tucker Report, §§ IV.A.1-2 and § IV.B.2.

[151] See above at ¶¶ 61

[152] See below footnote 303.

[153] Tucker Report, § IV.C.1.

commission structures, similar app store features, and similarly large numbers of apps. She

shows that in some cases Google made changes to its commission structure or store features after

Apple did.[154] However, one cannot infer from these facts that Apple's App Store competes with

Google Play Store. It is unsurprising that two firms operating in similar but separate markets,

which they each dominate, would structure their businesses similarly. And Dr. Tucker does not

account for similar worldwide litigation and regulatory changes against Apple and Google that

may affect their app store pricing practices. One does not see any of the hallmarks here of

competition, such as firms undercutting their rival's price. Dr. Tucker's evidence therefore

reinforces my conclusion that Google possesses significant market power.

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d)   Developers Use Android and iOS to Reach Different Sets of Consumers

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74.   Dr. Tucker also claims that developers substitute between Android and iOS in

releasing apps.[155] She primarily relies on statements from Apple and Google about what they do

to attract developers and how they compare their offerings.[156] However, this is not sufficient

evidence to claim that the Google Play Store and the Apple App Store are in the same relevant

market. In particular, it suffers from the Cellophane Fallacy.[157] Evidence that firms with

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[154] The standard test for establishing that two products are in the same relevant market is a SSNIP test, which is a small (the first "S" in SSNIP) price change, typically an increase of 5% or 10%. Thus, even if a feature such as offering a subscription game service causes consumers to switch products (or, in this case, causes the rival to adopt the feature), that is not evidence that the products are in the same relevant market. Rather, one must also establish that the feature is equivalent to a small price change, such as a 5% change in the commission rate that Google charges from the perspective of developers and users. Dr. Tucker does not establish that these features satisfy this condition, nor does she recognize that the size of the impact of the feature matters for a competitive analysis. *See e.g.* U.S. Horizontal Merger Guidelines, § 4.1.2; OECD, "Market Definition," 2012, at p. 30; Ulrick, Shawn W., et al., "Defining Geographic Markets with Willingness-to-Travel Circles," Supreme Court Economic Review, Vol. 28, No. 1, 2020, pp. 241-284, at 265 ("If the evidence shows that raising price by 50% from the competitive level causes a substantial number of consumers to switch to a substitute product, so much so that the price increase would be unprofitable, that is not evidence that the products are in the same relevant market because the price increase is too large.*")

[155] Tucker Report, ¶ 198.

[156] Tucker Report, § IV.C.3.

[157] *See* ¶ 72 above for a definition.

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substantial market power face some substitution at the margins is not evidence that the relevant product market needs to be expanded.[158]

75.   Furthermore, although Dr. Tucker asserts that there is substitution between app stores for developers, she does not address the level of substitution. In fact, Dr. Tucker states that the extent of substitution is, in fact, limited: "Developers with limited resources may need to launch their app on either the Apple App Store or the Google Play store before launching on the other app store."[159] Thus, according to her statement, the only developers that face the choice of which platform on which to first launch are those developers with limited resources and even then, only for a limited time. ██
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76.   But in fact, Dr. Tucker and I have a deeper disagreement. Whereas Dr. Tucker argues that developers view OSs as substitutes, in my Opening Report, I argue that for many developers, releasing apps for both Android and iOS are complements.[161] Dr. Tucker counters with evidence that developers sometimes select which system to prioritize in their development. However, there is no contradiction between her evidence and my claims. As I described in my Opening Report, many developers multi-home and view iOS and Android as complements.[162] The definition of a complement is that consuming one product enhances the utility of consuming the other product.[163] If the two products do not affect the utility of the other, they are independents.[164] Developing apps for iOS and developing apps for Android may be either complements as I argued in my Opening Report or they could be independents. For apps that have a social network element or data collection element, it is valuable to have as many

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[158] *See* Rysman Opening Report, ¶¶ 336-338 for a discussion of this point.

[159] Tucker Report, ¶ 198.

[160] Tucker Report, ¶ 200.

[161] Rysman Opening Report, ¶ 192

[162] Rysman Opening Report, ¶ 327.

[163] Samuelson, Paul, "Complementarity: An Essay on The 40th Anniversary of the Hicks-Allen Revolution in Demand Theory," *Journal of Economic Literature*, Vol. 12, No. 4, 1974, pp. 1255-1289, at 1255-1256, and 1259.

[164] Samuelson, Paul, "Complementarity: An Essay on The 40th Anniversary of the Hicks-Allen Revolution in Demand Theory," *Journal of Economic Literature*, Vol. 12, No. 4, 1974, pp. 1255-1289, at 1255-1256, and 1259.

consumers as possible on the app, so that the release of an app on a new platform enhances the value of the app on other platforms for the developer. Dr. Tucker never claims that releasing an app on Android makes the iOS app less valuable for a developer, or vice versa. Thus, she does not establish that the Android and iOS app stores are substitutes for developers. This also explains why Google did no more than match Apple's pricing rather than undercut Apple's pricing despite evidence that Apple offers a more profitable app store.[165] There is no need to undercut pricing of a complementary or independent product.

77.   In addition, just because we do not observe all app developers releasing every app simultaneously on all platforms does not mean that platforms are substitutes. If developers delay release on one platform, it is because the relative costs and benefits do not add up to an attractive option for the developer.

78.   Dr. Tucker's evidence of how developers release apps to different platforms supports my interpretation. Dr. Tucker's statements quoted above show that the importance of choosing between platforms is limited both in the number of developers and the length of time that it is relevant.[166] Also, it is clear from Dr. Tucker's statements that release on both platforms is generally desirable and, to the extent this choice is relevant, it is driven by resources, not because releasing on one platform causes release on the other platform to be less valuable. That is, Dr. Tucker does not show that releasing on one platform is a substitute for another platform.[167] In all of the examples of developers prioritizing iOS in paragraph 199 of her report, the developer releases on both platforms in less than a year (except Fortnite which released in 2 years).[168] That is consistent with my claim that developers view releases on different platforms as complements, or at least not substitutes.

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[165] Tucker Report, ¶ 212. Rysman Opening Report, footnote 651.

[166] *See* above ¶ 75.

[167] I view the "limited resources" that Dr. Tucker describes as an income effect in the sense that Samuelson (1974) describes. *See* below, footnote 338.

[168] Tucker Report, ¶ 199.

79.   In Rysman (2004), I present a formal mathematical model that clarifies these issues.[169] In the model, consumers make a discrete choice among available platforms. Consumers can choose only one platform. Sellers choose which platforms to sell on. Sellers may choose to be on as many platforms as they would like. I show simple assumptions under which the seller's decision is separable (*i.e.,* being on one platform does not make being on another platform more or less valuable). Thus, platforms are *independent* from the point of view of developers; platforms are neither substitutes nor, necessarily, complements.[170] As a result, pricing or investment by one platform may affect the value to a developer of selling on that platform but does not affect the value to a developer of selling at another platform, holding consumer choices constant. Naturally, attracting sellers still makes a platform more valuable to consumers, and consumer usage makes a platform more attractive to sellers. ██████████████████

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██.[171] Those discussions by Dr. Tucker are not evidence that developers substitute between iOS and Android.

80.   To be clear, my discussion of Apple and Google's *other* products as potential substitutes for consumers does not imply that these products are in the same relevant *two-sided* market. Dr. Tucker and I agree that iPhones and Android phones are substitutes for some consumers but, as Dr. Tucker recognizes, whether they are in the same relevant market depends on whether substitution from one device to the other is enough to deprive Google or Apple of

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[169] Rysman, Marc, "Competition Between Networks: A Study of the Market for Yellow Pages," The Review of Economic Studies, Vol. 71, No. 2, April 2004, pp. 483-512, at pp. 490-491.

[170] The assumption is that sellers have constant returns to scale – that is, costs scale up proportionally with quantity. As a result, sales at one platform do not make sales at another platform more or less costly, so there is no cost reason why selling at one platform affects the value of selling at another. Similarly, because consumers use only one platform, there is no demand-side reason why selling at one platform makes selling at another more valuable. This would not be the case if consumers were at multiple platforms, because then selling at one platform would cannibalize sales through another platform. Thus, platforms in this model are not complements or substitutes to each other. They are independent.

[171] *See e.g.*, Tucker Report, ¶¶ 188, 187, 201, 207, and 212.

substantial business.[172] As presented in Section III.C.1.a), I argue that the level of substitution is too low to include the Apple App Store in the Android App Distribution Market and in Section III.C.1.b) that substitution between Apple and Google is subject to the Cellophane Fallacy.

> e)   Disparate Pricing Between Android and iOS Devices Shows that Apple Is Not a Substitute to the Google Play Store

81.   Dr. Gentzkow's analysis of the prices of Android and iOS smart mobile devices is also relevant when considering whether Apple constrains the Google Play Store.[173] This is because the high price of smart mobile devices, and differences in the tendency of Android users to spend on technology, contribute to the cost of switching mobile OS, which prevents substitution from Android App Distribution to the Apple App Store.[174] I explain below that while Dr. Gentzkow's analysis shows a downward trend in Android device prices, it hides the widening gap between iOS and Android device prices.

82.   As Dr. Gentzkow notes, "[p]artly as a result of Google's decision to make key components of the Android ecosystem available for free, average prices for Android smartphones are relatively low and have fallen over time. This contrasts with prices for iOS smartphones which are higher and have been increasing… In 2021, the average price of Android smartphones was $239 compared with $967 for iOS smartphones"[175] This is a significant difference in the average price of smartphone between the two OSs of $728 in 2021.

83.   The trend in prices is also significantly different. Additionally, despite Dr. Gentzkow's characterization that Android device prices have been decreasing since 2008, his Exhibit 3 shows that Android average smartphone prices decreased from roughly $400 in 2008 to

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[172] See e.g. Tucker Report, ¶ 88 – 91 and footnote 56 citing to Rubinfeld, Daniel L., "Quantitative Methods in Antitrust," Issues in Competition Law and Policy, 2008, p. 728 ("Whether there is sufficient demand substitution to prevent the exercise of market power depends on the extent to which consumers will be diverted to other products in the face of a price increase (as measured by the price elasticity of demand for the product). Thus, identifying the structure of the demand for products is central to the analysis of market definition.").

[173] Gentzkow Report, Exhibit 3.

[174] I discuss this in more detail in my Opening Report, *See e.g.,* ¶¶ 171-173, and 186-191.

[175] Gentzkow Report, ¶ 161.

roughly $200 in 2017 Q1 but have shown a modest increase to approximately $240 in 2021Q3. During the same period, average iPhone prices have continued to increase from around $600 in 2008 to over $1,000 in 2021.[176] Dr. Gentzkow plots the two price charts separately with different scales, thereby minimizing their difference. In Exhibit 2 below, I recreate Dr. Gentzkow's Exhibit 3 by plotting the Android and iOS device prices on the same chart to demonstrate their differences.

Exhibit 2
Android and iOS Device Prices from Gentzkow Report Exhibit 3
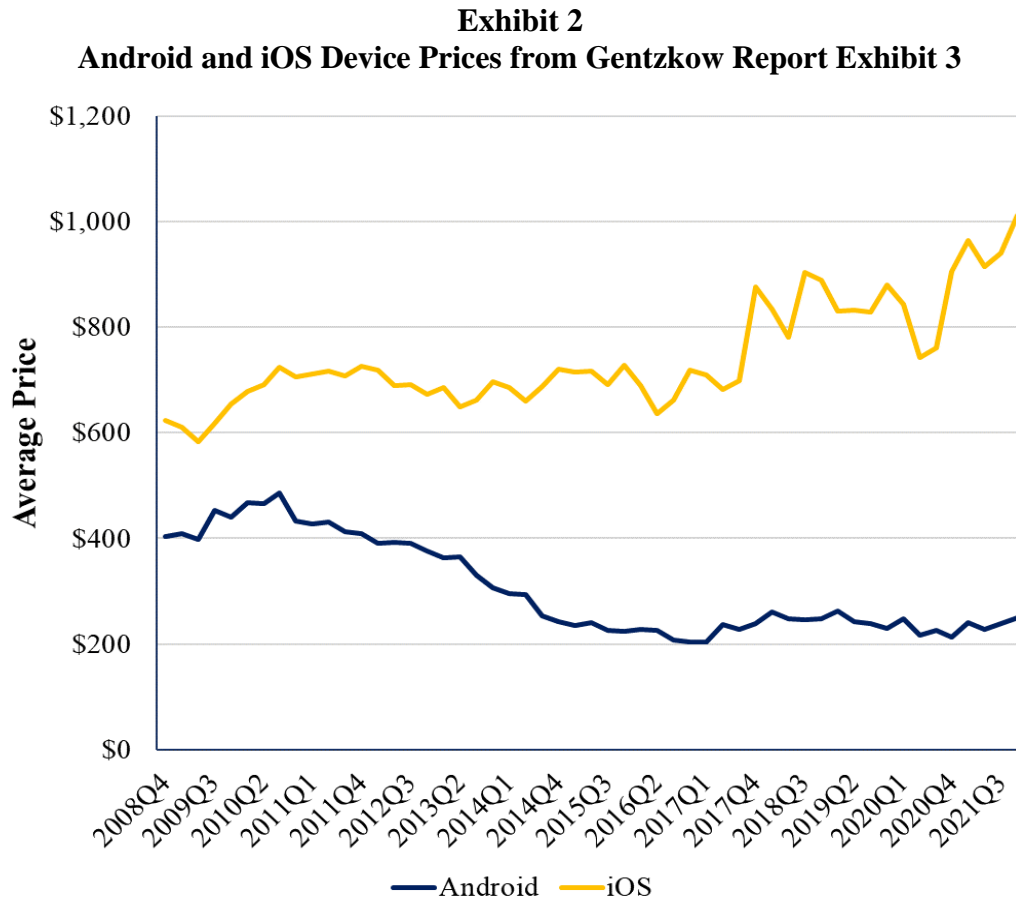
Sources: Gentzkow Report, Exhibit 3 (citing Bernheim Production Materials ("IDC Quarterly Mobile Phone Tracker"); "IDC's Worldwide Mobile Phone Tracker Taxonomy 2020," GOOG-PLAY-010801633-669).

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[176] Gentzkow Report, Exhibit 3. I present very similar statistics in my Opening Report (see Rysman Opening Report, Exhibit 51).

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84.   My analysis in my Opening Report also showed that Android dominates lower priced smartphones; between 2017 and 2021, Android's share of smartphones under $500 was 97%, whereas iPhone had just 3%. Of smartphones sold over $500, iPhone instead had a 64% share (compared with Android's 36% share).[177]

> f)   Summary of Dr. Tucker's Analysis that Apple Constrains Google in the Relevant Market

85.   To summarize, because Dr. Tucker fails to address the Cellophane Fallacy, fails to address the size of the investments she considers relative to a SSNIP, misunderstands the concept of complements, and mischaracterizes the interaction between consumers, platforms, and app developers, she fails to provide any convincing evidence that Apple provides a competitive constraint on Google in the antitrust sense sufficient to refute my SSNIP analysis.

> 2.   *Web Transactions Do Not Constrain Google In the Android App Distribution Market*

86.   Dr. Tucker argues that content subscriptions and purchases of other digital content on websites should be considered part of the relevant antitrust market and that they constrain Google's market power.[178]

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[177] Rysman Opening Report, ¶ 333 and Exhibit 50. *See also* Rysman Opening Report, Exhibit 49, showing a distribution of Android and iOS smartphones sold by price bracket.

[178] Tucker Report, § V.A.

[179] *See e.g.* Tucker Report, ¶¶ 220-221.

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87.   I also find that Dr. Tucker's claims that consumers or developers could shift to these alternatives, like web transactions (or web apps or gaming platforms discussed in the next section), are at odds with her position that when users encounter "roadblocks," like having to switch from a mobile app to a website, this creates a "negative spillover effect." While Dr. Tucker describes these negative spillovers affecting the platform, they may also directly affect the developer by making that developer less attractive to consumers who must travel to other channels to make their transactions.[180] Because Dr. Tucker does not provide enough consideration to these effects she incorrectly argues for a broader market.

88.   Dr. Tucker presents several analyses that compare the number of visitors and revenues on websites for select developers in Tables 4.A., 4.B, 5, and Figures 19-21. These analyses are not directly informative about the ability of developers to steer users to their websites for purchases because they are not limited to users that actually have or have used the native app. Some users may simply prefer to access these developers' content through the web rather than downloading an app and would not have considered downloading the app. Developers with limited visitors or revenue on their native apps are unlikely to be able to steer sufficient users away from Android App Distribution and constrain the prices of Google or a hypothetical monopolist.

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[180] Tucker Report, ¶ 112 ("For example, if a user encounters roadblocks to canceling a subscription in which they are no longer interested, this may be beneficial to the developer but may dissuade the user from trying out new subscriptions in other apps. That would be a negative spillover effect that would negatively affect other apps that offer subscriptions. If, instead, canceling a subscription was easy and hassle-free, this would encourage the user to try out new subscriptions in other apps, resulting in a positive spillover effect. The sponsor of a transaction platform like the Google Play store must work hard to ensure that these spillover effects are positive rather than negative. Successfully supporting positive spillover effects for users and developers enhances the value of network effects, which in turn creates more value for both sets of consumers of the Google Play store.")

89.   Similarly, the observation that some apps or types of apps are "consumption" only or monetize completely outside of Google Play does not imply that other developers could or would adopt this model.[181]

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██████████████████ However, the other Match Group sites started as websites and derive more revenue and visits from their websites.[183] Any signals about web usage from these apps are also likely to be affected by the age of users; OurTime, geared toward singles 50 and older, makes nearly all its revenue from the web, while Tinder, which Match describes as geared toward users aged 18-30,[184] ██████████████████████████████[185] Even the other Match Group sites rely on their apps for significant amounts of their revenue, and it is not clear that they could effectively shift this revenue to their websites.

91.   While some developers may have a business model that is amenable to shifting spending to a website, many others will face challenges. ████████████████████████████

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[181] Tucker Report, ¶ 224. See § 112 for further discussion of apps that are free to download and or monetized outside of Google Play.

[182] Stampler, Laura, "Inside Tinder: Meet the Guys Who Turned Dating Into an Addiction," Time, February 6, 2014, available at https://time.com/4837/tinder-meet-the-guys-who-turned-dating-into-an-addiction/.

[183] See Match Group, Inc., "Annual Report (Form 10-K)," February 24, 2022, p. 7 (explaining that Match, OkCupid and PlentyOfFish all launched online by 2004, before the launch of the first smartphone); Press Release, OurTime.com, "IAC, Operator of Match.com and Other Popular Dating Sites, Unveils New Online Dating Site for Singles 50-Plus," May 10, 2011, available at https://www.prnewswire.com/news-releases/iac-operator-of-matchcom-and-other-popular-dating-sites-unveils-new-online-dating-site-for-singles-50-plus-121552698.html (announcing launch of OurTime website, without any discussion of a mobile app).

[184] Match Group, Inc., "Annual Report (Form 10-K)," February 24, 2022, p. 6 (explaining that 'Tinder's patented Swipe technology has led to significant adoption, particularly among 18 to 30 year-old users, who were historically underserved by the online dating category").

[185] Tucker Report, Figure 20.

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████.[186] Tinder, ██ it is famous for

users interacting with it by "swiping right."[187] ████████████████████████████

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████████████████████████[188] Apps where users gain value from the native app

experience may have more difficulty selling in-app content to users outside of the app where the

app's value may be less apparent. Developers may be able to replicate some but not all of the

features of their apps with a web-app, but as I describe in Section III.C.3, web-apps are not a

viable substitute for developers and users. Users directed to a website from an app to make a

purchase will face a friction in completing their transaction. Dr. Tucker seems to agree that this

would be an issue for developers because the friction it creates could cause the consumer to

become less interested in interacting with the app or making additional purchases.[189]

      92.   Google recognizes that shifting transactions to the web would not be feasible for

many developers ██

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[186] Rysman Opening Report, ¶¶ 200-202.

[187] Stampler, Laura, "Inside Tinder: Meet the Guys Who Turned Dating Into an Addiction," Time, February 6, 2014, available at https://time.com/4837/tinder-meet-the-guys-who-turned-dating-into-an-addiction/.

[188] Adrian Ong (Match) Deposition at pp. 12–13 ████████████████████████████████

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[189] Dr. Tucker states, "For example, if a user encounters roadblocks to canceling a subscription in which they are no longer interested, this may be beneficial to the developer but may dissuade the user from trying out new subscriptions in other apps. That would be a negative spillover effect that would negatively affect other apps that offer subscriptions. If, instead, canceling a subscription was easy and hassle-free, this would encourage the user to try out new subscriptions in other apps, resulting in a positive spillover effect." While Dr. Tucker is discussing potential spillovers from the platform's perspective, these effects would naturally also affect developers who may find that customers are less likely to make additional purchases if they face roadblocks when they try, and I think she would agree with the statement if "canceling" was replaced with signing up for a subscription. *See* Tucker Report, ¶ 112.

[190] ██████████████████████ April 8, 2020, GOOG-PLAY-011546624 – 636, at 628.

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93.   Evidence from app developers also indicates that there would be challenges to shifting to a consumption-only model. ████████████████████████████

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██████████████████████████████[195] These estimated losses from shifting traffic to the web illustrate that for some developers without the scale or brand recognition of these large players, web transactions may not be a viable alternative.

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ignores that Google currently restricts the ability of apps to steer consumers to their websites to make purchases.[198] This means that web transactions do not discipline Google's market power in the status quo, even if they were in the market.

3.   *Dr. Tucker's Evidence Does Not Show Web Apps Constrain the Google Play Store*

95.   Dr. Tucker argues that web apps should be included in the relevant market, because "developers and users can and do engage in digital content transactions on websites and PWAs (Progressive Web Apps), rather than on app stores such as the Google Play store."[199] Further, she claims that the "evidence demonstrates that there is an ability to switch between app stores and websites/PWAs and that this exerts a competitive constraint on Google in operating the Google Play store." [200] However, the evidence Dr. Tucker uses to arrive at this conclusion is either irrelevant for the focal product, or does not prove that web apps are substitutable at a level that would constrain the hypothetical monopolist from imposing a SSNIP above a competitive benchmark.

96.   First, Dr. Tucker notes that apps such as Slack, Facebook, and Twitter exist as both native and web apps, "providing strong evidence that users have choices for interacting on" them.[201] But this may simply mean that the developers see the two channels as complements; if either provided access for all users, both would be unnecessary. In addition, Dr. Tucker presents evidence that Starbucks "doubled its daily active users after introducing its PWA."[202] But Starbucks does not monetize its in-app content.[203]

97.   Second, Dr. Tucker presents evidence that Tinder Online "enables users to access the app through their computer when they do not have access to their phones" and concludes that

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[198] Rysman Opening Report, ¶ 504.

[199] Tucker Report, ¶ 250.

[200] Tucker Report, ¶ 250.

[201] Tucker Report, ¶ 238.

[202] Tucker Report, ¶ 240.

[203] Rysman Rebuttal Report Backup Production.

"PWAs exert a competitive constraint on the Google Play Store" because developers do not pay service fees to Google even if the user completes the transaction on an Android device using the Google Chrome browser."[204] She goes on to say that "[i]f Google raised the quality-adjusted price of transactions via the Google Play store above the level that would prevail absent monopoly power, developers would have incentives to transact via PWAs instead," giving the example that Tinder Gold is $22.49/month via Tinder's PWA and $24.99 on the native app.[205] However, despite Google having raised its commission above the competitive level,[206] Dr. Tucker provides no evidence of Android users substituting from Tinder's Android app to Tinder's PWA despite the difference in price (or from any native Android app to any web app for that matter). Indeed, Google's policies prevent Tinder from leading users to its lower online price in its Android app.[207]

98.   Third, Dr. Tucker suggests that native apps and web apps should be in the same market because Apple has "limited the performance of PWAs by restricting access to push notifications" and thus "perceives PWAs as a competitive threat."[208] However, Dr. Tucker ignores her own framework that suggests market definition should focus on substitution from the focal product (the Google Play Store), not the response of an alternative mobile operating system (iOS), which for all the reasons I explain in my Opening Report is not in the relevant market.[209]

99.   Fourth, Dr. Tucker suggests that Google's support for PWAs is "competition with Apple by differentiating the tools it offers to support developers and users that are not available

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[204] Tucker Report, ¶¶ 242-244.

[205] Tucker Report, ¶ 244.

[206] Rysman Opening Report, ¶ 340.

[207] See, e.g., https://support.google.com/googleplay/android-developer/answer/10281818#zippy=%2Ccan-i-communicate-with-my-users-about-alternative-ways-to-pay%2Ccan-i-communicate-with-my-users-about-promotions-on-other-platforms ("Within an app, developers may not lead users to a payment method other than Google Play's billing system unless permitted by the Payments policy. This includes directly linking to a webpage that could lead to an alternate payment method or using language that encourages a user to purchase the digital item outside of the app.")

[208] Tucker Report, ¶ 247.

[209] Rysman Opening Report, § V.C.4.

from Apple."[210] However, the evidence Dr. Tucker presents suggests that Google's motivations for improving and enhancing PWAs performance could be equally motivated by competitive pressure in a market for browsers (and the Google Chrome Browser). For example, the website quoted by Dr. Tucker also notes that "[t]he description and screenshots properties are currently used only in Chrome for Android and require an experimental flag to be enabled in Chrome 90."[211] It is not as seamless as a native app as users must go through an extra step to enable it and that "if a user opts not to install a progressive web app for a site they frequently visit, they may have to constantly deal with the pop-up, which could get annoying fast."[212]

100.   Fifth, I would note that Dr. Tucker does not dispute the evidence presented in my Opening Report, particularly that:

- Web-based apps often have longer response times and are harder to navigate, resulting in a worse user experience.[213] Web apps also require connection to the internet.[214]

- In 2012, Facebook decided to move away from an HTML5 version to a native app because of limitations in "performance and feature set" such as sub-optimal experience of using cameras on the mobile web.[215]

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[210] Tucker Report, ¶ 249.

[211] Russell, Brandon, "Installing a PWA is about to feel more native on Android," XDA Developers, March 29, 2021, available at: https://www.xda-developers.com/installing-pwa-more-native-on-android/.

[212] Russell, Brandon, "Installing a PWA is about to feel more native on Android," XDA Developers, March 29, 2021, available at: https://www.xda-developers.com/installing-pwa-more-native-on-android/.

[213] Rysman Opening Report, ¶ 214 citing to GeeksforGeeks, "Difference between Native Apps and Web Apps," March 31, 2021, available at https://www.geeksforgeeks.org/difference-between-native-apps-and-web-apps/; Store and Rooche, "What are the Benefits of Native App?" June 20, 2022, available at https://rooche.net/benefits-of-native-app/.

[214] Rysman Opening Report, ¶ 213, citing to GeeksforGeeks, "Difference between Native Apps and Web Apps," March 31, 2021, available at https://www.geeksforgeeks.org/difference-between-native-apps-and-web-apps/; Store and Rooche, "What are the Benefits of Native App?" June 20, 2022, available at https://rooche.net/benefits-of-native-app/.

[215] Rysman Opening Report, ¶ 215 citing to Langel, Tobie, "Introducing the Mobile W3C Community Group," Facebook Developers, February 27, 2012, available at https://web.archive.org/web/20120511110804/http://developers.facebook.com/html5/blog/post/2012/02/27/introducing-the-mobile-w3c-community-group/. See also Reisinger, Don, "Facebook close to launch of native Android app – report," CNET, October 8, 2012, available at https://www.cnet.com/tech/services-and-software/facebook-close-to-launch-of-native-android-app-report/.

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- Data from Comscore indicates users spend the vast majority (over 85% in all countries) of their time in native apps.[217]

101.   Moreover, one of Dr. Tucker's sources on PWAs states "[b]ut there's one near-golden rule about web apps: the native app is probably better," referring to the situation prior to progressive web-apps.[218] ███████████████████████████████████████
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[216] Rysman Opening Report, ¶ 212 citing to Google, ██████████████████ GOOG-PLAY-001882239.R-299.R, at 256.R.

[217] Rysman Opening Report, ¶ 216 citing to Comscore, "Global State of Mobile," November 2020, available at https://www.comscore.com/content/download/51336/2998036/file/2020_Global_State_of_Mobile.pdf, at p. 5. Dr. Tucker in response to Dr. Bernheim, compares visit count on native apps and web apps in Figures 32.A and 32.B of her report, and argues visit count may be more appropriate. I am not persuaded by Dr. Tucker's analysis of visitor counts because she studies broad categories, and does not actually show that for the same app visitors would or could visit both the native and web app version. There could be a number of developers in "General News" for example whose business model causes them to focus on web exclusively. Further, games is one of the most important categories for Google Play in terms of spend (*See* Tucker Report,¶ 273) and the visits to the native app are a significant majority of visits in that category (*See* Tucker Report, Figure 32.A).

[218] Miller, Paul, "Web apps are only getting better," The Verge, April 11, 2018, available at: https://www.theverge.com/circuitbreaker/2018/4/11/17207964/web-apps-quality-pwa-webassembly-houdini. While

[219] Rysman Opening Report, ¶ 212 citing to Google, ██████████████████ GOOG-PLAY-001882239.R-299.R, at 274.R.

[220] Google, ████████████ October 9, 2018, GOOG-PLAY-007310413-418, at 418; *see also* Google, ████████████████████████████████ June 28, 2018, GOOG-PLAY-004453915-924, at 917 ██
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[REDACTED] [221] [REDACTED]

[REDACTED] [222] [REDACTED] [223] [REDACTED] [224] and [REDACTED]

[REDACTED] [225] [REDACTED] ,[226]

Dr. Tucker's focus on PWAs ignores the limitations of web-apps more generally that have existed throughout the period in which Google is alleged to have engaged in the conduct.[227]

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[221] Patel (Nvidia) Deposition, pp. 74-75 [REDACTED]

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[REDACTED] ; pp. 200-201 [REDACTED]

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[222] Goodger (Google) Deposition, p. 46 [REDACTED]

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[223] Goodger (Google) Deposition, p. 43 [REDACTED]

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[224] Goodger (Google) Deposition, p. 45 [REDACTED]

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[225] Google, [REDACTED] June 28, 2018, GOOG-PLAY-004453915-924, at 916 [REDACTED] .

[226] Google, [REDACTED] June 28, 2018, GOOG-PLAY-004453915-924, at 918 [REDACTED] .

[227] Facebook's experience suggests there were limitations to web-apps in at least 2012. *See* Reisinger, Don, "Facebook close to launch of native Android app – report," CNET, October 8, 2012, available at https://www.cnet.com/tech/services-and-software/facebook-close-to-launch-of-native-android-app-report/. [REDACTED]

[REDACTED] *See* Babcock (Epic) Deposition, pp. 314-315 [REDACTED]

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102.   Finally, I note that Dr. Gentzkow claims that "[w]eb apps are another alternative channel that is accessible on Android devices."[228] ████████████████████████████████

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██"[229] In addition, he also cites Google promoting Progressive Web Apps ("PWAs") since 2015, and suggests that they are "becoming increasingly popular due to lower development costs and complexities while at the same time providing users with many of the benefits of native apps."[230]

103.   However, Dr. Gentzkow provides no evidence that web apps are making a meaningful difference to competition in Android App Distribution. ████████████████████

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4.   Gaming Platforms Are Not in the Android App Distribution Market, Contrary to Dr. Tucker's Claims

104.   Dr. Tucker argues that Google faces competition with gaming platforms (i.e., app stores on consoles and PCs) in the relevant antitrust markets.[233] ████████████████████████

[228] Gentzkow Report, ¶ 213.

[229] Gentzkow Report, ¶ 214.

[230] Gentzkow Report, ¶ 216.

[231] Rysman Opening Report, ¶¶ 211 - 217.

[232] Rysman Opening Report, ¶ 218.

[233] Tucker Report, § V.C.

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████.[234] ███

█████████[235] I describe the problems with her evidence below.

105.   Google, like any monopolist, will face some substitution at the margins, and even a firm with market power may feel compelled to innovate at times. █████████████████

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███████████████[236] A firm with significant market power in a market, like Google enjoys in Android App Distribution and In-App Billing Services, may almost by definition view their main competitors as firms that are outside of the relevant antitrust market. This is one reason why the views of executives may not be aligned with how antitrust markets are defined. ██████████

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███████████[237] ███

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██[239] As discussed above, firms with market power have a reduced incentive to innovate but still may

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[234] *See e.g.,* Tucker Report, ¶¶ 273, and 298-305.

[235] *See e.g.,* Tucker Report, ¶¶ 282-298.

[236] Tucker Report, ¶ 299. *See also* ¶ 300-302. ████████████████████████
██████████████████████████████ (*see* Tucker Report, ¶ 279-280, and 300), however, this merger was announced in 2022 and has been challenged by the FTC. The business strategy that Microsoft hopes to pursue in this deal may not reflect current or past substitution behavior by users and developers in the Android App Distribution market-instead it may reflect Microsoft's predictions for the future that may or may not turn out to be realistic, and Dr. Tucker does not appropriately evaluate this possibility. Novet, Jordan and Lauren Feiner, "FTC sues to block Microsoft's acquisition of Activision Blizzard, " CNBC, December 8 2022, available at https://www.cnbc.com/2022/12/08/ftc-sues-to-block-microsofts-acquisition-of-game-giant-activision-blizzard.html.

[237] Tucker Report, ¶ 303-305.

[238] Google, ████████████ October 2020, GOOG-PLAY-000091853.R-922.R; Google, ██████████
████████████ GOOG-PLAY-002653755.R-774.R; and Google, ████████████████
█████ November 2019, GOOG-PLAY-002432994.R-031.R at 007.

[239] Google, ████████████████████████████" June 2018, GOOG-PLAY-000375525.R-582.R; Google, █████████████████████████████████ July 24, 2018, GOOG-PLAY-000289306-335; Google, █████
████████████ GOOG-PLAY-000571373.R-388.R; and Google, ████████████████████
GOOG-PLAY-000300552.R-597.R

innovate, so these programs do not disprove Google's market power. ████████████

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106.   I explained in my Opening Report that the average user experience on PCs and game consoles is different than on smart mobile devices.[241] There may be more similarity for games, but there are still important differences. For example, games (and other apps) on smart mobile devices can take advantage of unique hardware (e.g., touch screens, accelerometers, or gyroscopes), and may not function well with a mouse or video game controller.[242] Consider, for example, the mobile gaming app Pokémon GO, in which users explore the outdoors with their smart mobile device.[243] Consumers can use their mobile devices anywhere and spend on average 4.1 hours daily on their mobile devices.[244] Desktop PCs, laptops, and most gaming consoles are larger and not easy to use and access "on the go."[245] They are also purchased for different purposes than mobile devices.[246] These differences in use cases mean that consumers that want to access their content "on the go" would be less likely to switch to gaming consoles, PCs, or laptops in response to a change in the price of apps or in-app content on their Android device. Also, as I explained in my Opening Report, "mobile games tend to be casual games that appeal to mass audiences, whereas, PC and console games have higher quality, offer a more immersive

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[240] *See* Tucker Report, ¶ 500-502.
[241] Rysman Opening Report, ¶¶ 200-204.
[242] Rysman Opening Report, ¶ 200.
[243] Rysman Opening Report, ¶ 215.
[244] Rysman Opening Report, ¶ 200.
[245] Rysman Opening Report, ¶ 200.
[246] Rysman Opening Report, ¶ 203.

experience and attract more dedicated games."[247] A comparison of the top 45 games on the Google Play store and Steam, showed only three apps available on both.[248]

107.   Dr. Tucker does not seem to account for this in her analysis, but instead points to some new technologies like cloud gaming, and the Steam Deck.[249] The Steam Deck was only released in February 2022, and Dr. Tucker does not analyze the extent of its adoption among Android users. I note that this device currently costs $399 to $649, and therefore Android users who want to shift their current spending on games on their Android devices would need to determine the additional cost was worth it.[250] Dr. Tucker does not analyze the extent to which Android users would be willing to purchase these devices. Cloud gaming is a recently developed technology, that allows users to play games that are running on a remote data center from their devices.[251] According to Dr. Tucker's Table 7, the earliest cloud gaming was available was November 2019, and has not been available on every platform during the last two years.[252]

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108.   ██

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[247] Rysman Opening Report, ¶ 203

citing to Starloop Studios, "Mobile Games Vs. PC Vs. Console Games: What Market is the Best Bet?" available at https://starloopstudios.com/mobile-games-vs-pc-vs-console-games-what-market-is-the-best-bet/.

[248] Rysman Opening Report, ¶ 203.

[249] Tucker Report, ¶¶ 306, and 307-316.

[250] "Steam Deck," Valve, available at https://www.steamdeck.com/en/.

[251] Tucker Report, ¶ 307.

[252] Tucker Report, Table 7.

[253] Patel (Nvidia) Deposition, at pp.160-161. ████████████████
████████████████████████████████ *See* Patel Deposition, at pp. 163-165.

[254] Patel (Nvidia) Deposition, at 179-181. *See also* Patel Deposition, at p.145 ████████████████
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109.   Google is shutting down their cloud gaming service Stadia.[258] Microsoft, in its response to the CMA's "Phase-2" investigation into its acquisition of Activision Blizzard, stated that cloud gaming is a "new and immature technology which the CMA has recognized faces significant challenges." It also stated that consumer uptake "is not expected to be rapid as it requires a significant change in consumer behavior."[259] ████████████████████████████ ████████████[260] Dr. Tucker's discussion of cloud gaming does not address this evidence, and fails to show that cloud gaming would have constrained Google's market power or the ability of a hypothetical monopolist to raise prices in Android App Distribution.

110.   Dr. Tucker also describes how some games allow users to make purchases on one platform and then use those purchases on other platforms where they have the game.[261] However, she mentions seven example games: Fortnite, Roblox, Genshin Impact, Vainglory, Lineage M, Lords Mobile, and PUBG Mobile.[262] Dr. Tucker analyzes in some detail spending behavior by

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[255] Patel (Nvidia) Deposition, at pp. 181-182; 192; 245-46.

[256] Patel (Nvidia) Deposition, at pp.145-146.

[257] Patel (Nvidia) Deposition, at pp.146-147.

[258] Peters, Jay and Alex Cranz, "Google is shutting down Stadia," The Verge, September 29, 2022, available at https://www.theverge.com/2022/9/29/23378713/google-stadia-shutting-down-game-streaming-january-2023.

[259] Wolens, Joshua, "Microsoft has a bleak outlook on cloud gaming's future," PC Gamer, October 20, 2022, available at https://www.pcgamer.com/microsoft-has-a-bleak-outlook-on-cloud-gamings-future/.

[260] Patel Deposition, at p. 159.

[261] See e.g., Tucker Report, ¶ 281.

[262] Tucker Report, ¶¶ 281, 294, and 295.

Fortnite and Roblox users but does not present an analysis of the behavior of the users of the other games.[263] Further, she does not put these games into context. ██████████████

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██[264] ████████████████████████

██████████████████████████████████████[265] to other devices in response to an increase in the price of apps in the Android App Distribution market would be sufficient to discipline Google or the hypothetical monopolist in the market generally, across all apps. Further, this ignores many other games that are not currently cross-platform. Some developers may not be willing to implement cross-platform capabilities because it is costly do so.[266] As I discuss below in Section IV.B.3, Dr. Tucker's claim that competition that is "local," *e.g.* limited to a specific segment of apps, can constrain Google's market power is both theoretical and undercut by the fact that Google has often lowered its commission only for select sets of developers rather than all developers.

111.   There are examples of well-known games which are not available across platforms, or do not have the ability to transfer progress across platforms:

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[263] *See* Tucker Report, ¶¶ 281-293 and 296-297.

[264] Rysman Rebuttal Report Backup Production. Certain games were not available on Google Play Store during all of 2020, for these games I calculate their share of spend for the months they were available. Vainglory stopped supporting in-app transactions in April 2020 and is not included in the range above. *See* Bengel, Chris, "Fortnite removed from App Store and Google Play, Epic Games files lawsuit against Apple," *CBS Sports*, August 17, 2020, available at https://www.cbssports.com/general/news/fortnite-removed-from-app-store-and-google-play-epic-games-files-lawsuit-against-apple/; Genshin Impact, "Genshin Impact Official Launch Time and Recommended Device Specs," September 8, 2020, available at https://genshin.hoyoverse.com/en/news/detail/5284. Vainglory, "Vainglory: Community Edition," April 1, 2020, available at https://www.vainglorygame.com/news/vainglory-community-edition/.

[265] Tucker Report, ¶ 292 ██

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[266] Rysman Opening Report, ¶ 207.

NON-PARTY AND PARTY HIGHLY CONFIDENTIAL – OUTSIDE COUNSEL EYES ONLY

- A game like Pokémon Go, which accounted for 2.06% of spend in the games category on Google Play in 2020 in the U.S.,[267] is specifically designed to take advantage of mobile functionality and would likely find shifting spend to non-mobile platforms difficult.

- The game Coin Master was the 1st ranked game by spend in 2020 (accounting for 2.88% of spend in the games category on Google Play in the U.S.) and is available only on iOS and Android.[268] Similarly, Call of Duty Mobile, which accounted for 0.9% of spend in the games category on Google Play in 2020 is available only on iOS and Android.[269] Other games in the top 200 by spend on Google Play in the game category in the U.S. which were available only on iOS and Android are Fate/Grand Order, Fire Emblem Heroes, Legendary Game of Heroes, and Disney Heroes: Battle Mode.[270] Because users typically single home between iOS and Android,[271] developers with games that are available only on mobile would find it difficult to effectively shift spend across platforms.

112.   Finally, Dr. Gentzkow asserts that "Cloud gaming services are an important channel by which game developers can reach users without using traditional apps" as "[a]pp developers can access a larger gaming population, including a new base of users that would not have tried the game if they had to invest in a console or other device."[272] ███████████████

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[267] Rysman Rebuttal Report Backup Production. Only iOS and Android devices are included in its list of supported devices. *See* Pokemon Go Help Center, "Supported Devices," available at https://niantic.helpshift.com/hc/en/6-pokemon-go/faq/92-supported-devices/.

[268] Rysman Rebuttal Report Backup Production. Moonactive, "Our Games," available at https://www.moonactive.com/.

[269] Rysman Rebuttal Report Backup Production. Activision, "Call of Duty Mobile," available at https://www.activision.com/games/call-of-duty/call-of-duty-mobile.

[270] Rysman Rebuttal Report Backup Production. "Fate Grand Order," available at https://fate-go.us/; "Fire Emblem Heroes," available at https://fire-emblem-heroes.com/en/; "Legendary Game of Heroes," available at http://legendary.n3twork.com/; "Disney Heroes Battle Mode," available at https://www.disneyheroesgame.com/.

[271] Rysman Opening Report, ¶ 330.

[272] Gentzkow Report, ¶ 208.

NON-PARTY AND PARTY HIGHLY CONFIDENTIAL – OUTSIDE COUNSEL EYES ONLY

█████[273] and Dr. Gentzkow provides no evidence ████████████████████████

███████████████████████████[274]) that cloud gaming has or will make a meaningful impact

on how the vast majority of developers (who are not major cross-platform game developers)

access Android users.[275]

5.   *The Fact that Some Apps Are Free to Download and Others Are Monetized Through Ads or Other Means Does Not Alter My Opinions*

113.   Dr. Tucker explains that Google's monetization strategy for the Google Play store

involves giving developers several options and allowing developers to choose not to monetize

their apps.[276] She states that because of this Android App Distribution and Android In-App

Billing Services on Android are not relevant antitrust markets and that I have not accounted for

Google's monetization strategy appropriately in my analysis.[277] As I explain below, the presence

of apps with monetization strategies other than collecting payments for initial downloads or for

access to in-app content does not change my opinions on market definition or market power.

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[273] ██ *See*, Rysman Opening Report, ¶ 209. Google, ██████████████████████ May 2019, GOOG-PLAY-000231487-551, at 489.

[274] Gentzkow Report, ¶ 209.

[275] In a recent interview on the Decoder podcast, the CEO of Microsoft Gaming noted he believes cloud streaming in gaming would be of limited importance and expects consumers to continue buying and owning games for a long time to come. *See* Patel, Nilay, "Phil Spencer really wants you to know that Native Call of Duty will stay on PlayStation," *The Verge*, November 15, 2022, available at https://www.theverge.com/23459189/phil-spencer-microsoft-activision-call-of-duty-xbox-playstation-candy-crush-apple-fortnite-vr.

[276] Tucker Report, ¶ 131.

[277] Tucker Report, ¶ 131 and ¶ 375.

[278] Tucker Report, ¶ 133.

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████████████████████████████████████[280] Google may also stand to profit from the presence of these apps in the app store in other ways *e.g.,* by increasing the attractiveness of the Android OS driving business to Google Search and other Google products. However, Google's incentives related to its broader business are not relevant to the question of how consumers and developers would substitute away from Android App Distribution in response to a price increase which is the core question for market definition. If consumers and developers are not able or willing to substitute away from Android App Distribution, then Google may be able to leverage that market power to engage in exclusionary conduct and charge supercompetitive prices.

115.   Dr. Tucker devotes almost an entire section of her report to explaining that Google's strategy for monetizing the Play store involves allowing developers to follow the "freemium model."[281] This model may be part of how Google in the actual world was able to earn profits from the Play Store, but in the but-for world, Google would still have been able to allow free downloads and charge a commission, albeit a lower one (although its profits may have been less than what it earned in the world where it also engaged in exclusionary conduct). Overall, the fact that the "freemium model" is so important to developers is evidence that Google has market power in the relevant markets: if all developers were willing to forgo using Google Play for in-app billing services and become ad supported through Google or monetize their app in other ways, then Google would be forced to lower its commission, earn lower profits, and otherwise improve the terms trade.

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[279] Tucker Report, ¶ 133. Google, "Google Play Developer Distribution Agreement," November 17, 2020, GOOG-PLAY-000053875-878.

See also, Play Console Help, "Payments," available at https://support.google.com/googleplay/androiddeveloper/answer/9858738.

[280] Of the "95.5% of new apps released on the Google Play store in May 2021 that did not monetize through the Google Play store," 53.12% were monetized through ads. Tucker Report, ¶ 133, Rysman Rebuttal Report Backup Production.

[281] Tucker Report, ¶¶ 132-147.

116.   Dr. Tucker claims that the fact that other platforms use a "freemium" model is "evidence of the value provided by this fee structure as opposed to any reflection of monopoly power."[282] The observation that other firms with potentially the same, less, or more market power offer products with similar terms of trade is not informative about whether Google possesses market power in the relevant antitrust markets. Posted prices are offered by firms of all types across many industries, some of which are competitive, which is likely explained by posted prices being a valuable way to structure trade in many markets. Firms having adopted posted prices is not evidence that they lack market power.

117.   Dr. Tucker implies that my analysis does not "account for the interrelationships between all the free transactions enabled by the Google Play store and any subsequent services fees paid."[283] However, my market definition matches the interrelationships between the markets. App developers and users choose whether to offer or download apps and in-app content on Android devices free or otherwise in the Android App Distribution market and developers pay a commission to Google to use its billing services in the Android In-App Billing Services market. The free downloads are included in the Android App Distribution Market, not "ignored" as Dr. Tucker implies – she later criticizes me for including them.[284]

118.   By focusing on in-app billing services, Dr Tucker claims that I inappropriately ignore alternative monetization strategies for app developers.[285] However, analysis of switching between monetization strategies indicates that app developers usually use a single strategy and do not switch strategies often.

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[282] Tucker Report, ¶ 147.
[283] Tucker Report, ¶ 18 and 149.
[284] Tucker Report, ¶ 149 and 375.
[285] Tucker Report, ¶ 33.

Exhibit 3
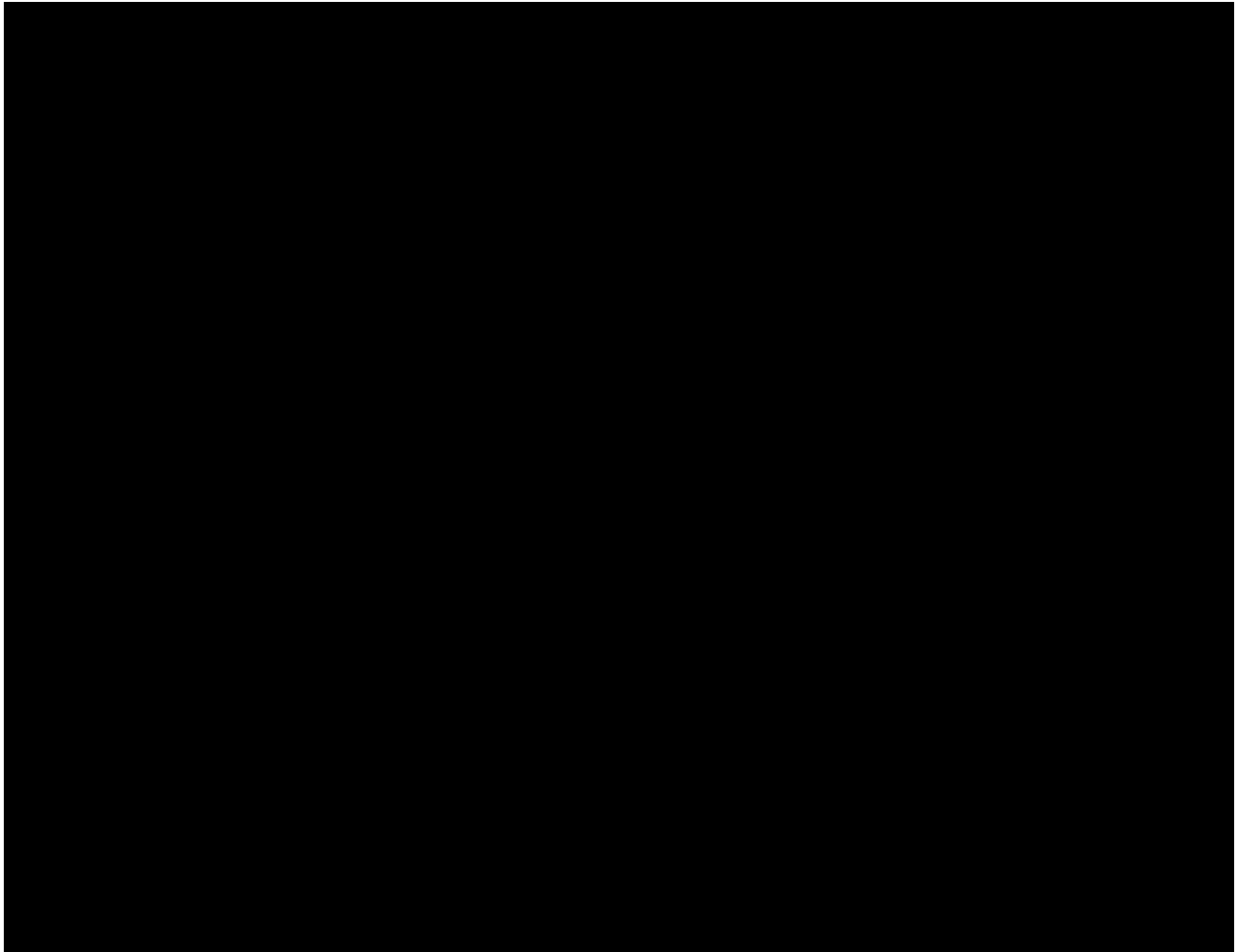
Sources:

1. GOOG-PLAY-005535886.

2. GOOG-PLAY-010801688.

3. GOOG-PLAY-005535888.

4. Letter from Brian Rocca, counsel for Google, to Melinda R. Coolidge, "Re: In re Google Play Store Antitrust Litigation, No. 3:21-md-02981-JD (N.D. Cal.), Epic Games, Inc. v. Google LLC et al., No. 3:20-cv-05671-JD (N.D. Cal.), In re Google Play Consumer Antitrust Litigation, No. 3:20-cv-05761-JD (N.D. Cal.), In re Google Play Developer Antitrust Litigation, No. 3:20-cv-05792-JD (N.D. Cal.)," September 3, 2021.

120.

Exhibit 4

Sources:

1. GOOG-PLAY-005535886.
2. GOOG-PLAY-010801688.
3. GOOG-PLAY-005535888.
4. Letter from Brian Rocca, counsel for Google, to Melinda R. Coolidge, "Re: In re Google Play Store Antitrust Litigation, No. 3:21-md-02981-JD (N.D. Cal.), Epic Games, Inc. v. Google LLC et al., No. 3:20-cv-05671-JD (N.D. Cal.), In re Google Play Consumer Antitrust Litigation, No. 3:20-cv-05761-JD (N.D. Cal.), In re Google Play Developer Antitrust Litigation, No. 3:20-cv-05792-JD (N.D. Cal.)," September 3, 2021.

121.   The limited switching and limited use of multiple monetization strategies give

additional support for focusing on in-app billing services. Finally, any competitive constraint

arising from the availability of other monetization strategies does not appear to have restrained

Google's market power in the Android In-App Billing Services Market as evidenced by the supra-competitive prices and high margins that it has been able to maintain.[286]

> **D.   Dr. Tucker Fails to Show that Android App Distribution and In-App Billing Services are Not Relevant Antitrust Markets**
>
> *1.   Dr. Tucker's Claim that Android App Distribution and In-App Billing Services are Not Separate Relevant Antitrust Markets Misunderstands Key Points*

122.   Dr. Tucker argues that Android app distribution and in-app billing services should be a single market.[287] However, she never argues that consumers or developers substitute between these markets. Rather, she makes a series of arguments that are not relevant for market definition.

> a)   App Developers Monetization Strategies Do Not Affect My Market Definition

123.   First, Dr. Tucker criticizes the Android App Distribution Market because it "results in a market that consists almost entirely of free products."[288] She says this is problematic because "this market definition fails to reflect important competitive realities regarding the Google Play store."[289] This is flawed for several reasons. To begin with, market definition is meant to reflect how consumers substitute between products.[290] There is no requirement that products must be paid for. Dr. Tucker also seems to ignore that the Google Play Store operates with a two-sided strategy. It is unsurprising that Google might offer Android users prices of $0

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[286] *See* Rysman Opening Report, § VI.C.

[287] Tucker Report, ¶¶ 373-374.

[288] Tucker Report, ¶ 375.

[289] Tucker Report, ¶ 375.

[290] Rysman Opening Report, ¶ 117. *U.S. Merger Guidelines*, § 4. The European Commission takes a consistent approach to market definition: "The question to be answered is whether the parties' customers would switch to readily available substitutes or to suppliers located elsewhere in response to a hypothetical small (in the range 5 % to 10 %) but permanent relative price increase in the products and areas being considered. If substitution were enough to make the price increase unprofitable because of the resulting loss of sales, additional substitutes and areas are included in the relevant market. This would be done until the set of products and geographical areas is such that small, permanent increases in relative prices would be profitable." *See* Commission Notice, ¶ 17.

for most apps or even negative prices (consumer subsidies) in order to make the Play store more attractive to developers. Dr. Tucker and Dr. Gentzkow argue repeatedly that the "freemium" app model allows developers to maximize profits and, indeed, fault my SSNIP for not using transaction data for free apps that Google did not produce;[291] it would make no sense to find a market improper because it included these apps. Finally, Dr. Tucker fails to recognize that "free" apps may involve an exchange with the user of something besides monetary consideration. For instance, if we defined the relevant consumer market for social media apps such as Meta's Facebook product, that might be made up entirely of "free" products, but only if economists ignore the data that users share to drive Facebook's monetization. Dr. Tucker's criticism misunderstands market definition for antitrust purposes.

124.   Second, Dr. Tucker argues that in defining the Android App Distribution and the Android In-App Billing Services Markets my definitions do not capture the dynamics of products with in-app content. She states, ███████████████████████████████████ ██████████████████████████████████████ ████████████████████████████[292] However, this is exactly the behavior that my market definition captures. Consumers can choose to download apps in the Android App Distribution Market and then choose whether to consume in-app content. Separately, developers choose a vendor for In-App Billing Services as part of providing in-app content to consumers. Dr. Tucker generally references substitution in her report, for example that a "relevant antitrust market must include relevant transactions that are sufficiently substitutable," but the substitution she describes here is not between products but rather whether or not to buy in-app content conditional on having downloaded the app.[293] Obviously, even a monopolist protected by a substantial barrier to entry must contend with consumers that can choose not to make purchases, and this is accounted for in my SSNIP.[294]

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[291] Tucker Report, ¶ 476 and Gentzkow Report, ¶ 80.

[292] Tucker Report, ¶ 376.

[293] Tucker Report, ¶ 376.

[294] Rysman Opening Report, ¶ 224.

<blockquote>
b)   Google's Monetization Strategy Is Not Directly Relevant to Market Definition
</blockquote>

125.   Dr. Tucker states that "[s]eparating app downloads and other kinds of digital content transactions into separate markets does not make sense because the relationship between the two is important to Google's competitive strategy for the Google Play store."[295] This is related to a contention that Dr. Tucker makes throughout her rebuttal report (noted above), that only by looking at the entire ecosystem of the Android operating system can we understand Google's constraints on competition.[296] For instance, Dr. Tucker states that "Separating Google's Android ecosystem into … discrete markets means that Plaintiffs' expert reports define away the Android ecosystem's competition with Apple and other alternatives that competitively constrain Android and the Google Play store."[297] She also claims that the monetization strategy of the producer of a product should inform market definition.[298] She is not explicit about what is meant by a "monetization strategy" and it is not a standard term in economics, but presumably, she means of that if a firm offers one product for free and collects revenue on another product, those products should be in the same market.

126.   However, the purpose of market definition in an antitrust analysis is to understand demand substitution.[299] It is not to understand the ecosystem or the monetization strategy of the firms. The DOJ/FTC merger guidelines do not contain the terms "ecosystem" or "monetization strategy."[300] At the market definition stage, it is appropriate to begin the analysis with the products involved in the conduct, study the relevant forces of demand substitution, and use that

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[295] Tucker Report, ¶¶ 376-377.

[296] *See* Tucker Report, ¶ 14. *See also* Tucker Report, ¶¶ 32-33 and 116-117 and generally §§ III.C, IV.A, IV.B.1, and VI.B.

[297] Tucker Report, ¶ 32.

[298] Tucker Report, ¶ 39 ("The Rysman, Schwartz, Singer and Tadelis Reports' approach to defining a separate market for Android in-app billing services is flawed. It ignores that the service fee for select digital content transactions on the Google Play store is a monetization strategy that helps fund the entire ecosystem and all the value unlocked within it. It also ignores that as a monetization strategy it unlocks value for users and developers, and the Google Play store is only paid if it creates sufficient value.")

[299] Rysman Opening Report, ¶ 117.

[300] *See* U.S. Merger Guidelines. The term "business strategy" also does not appear.

information to define relevant markets.[301] The potential implications of other related products that are not relevant demand substitutes, *i.e.,* other parts of the ecosystem, should be considered at a later stage in the analysis to the extent they would affect the analysis of market power or competitive effects.[302] One article in the literature explicitly cautions against uncritically relying on documents and testimony that discuss the business strategies of the firms, explaining that "there is no reason to expect that the concept of market employed by business executives when discussing issues of business strategy or marketing, would be the same as the concept of an "antitrust market" or "relevant market" defined for the purpose of antitrust analysis."[303] Business strategies may account for many more factors than the level of demand substitution relevant to defining antitrust markets.

127.   A well-known example is *United States v Microsoft* (1999), which illustrates why considering the "ecosystem" in market definition would lead to defining markets that do not seem to follow the basic economic principles of market definition. Presumably, Dr. Tucker would find that for Microsoft in the 1990's, Windows and Internet Explorer (the browser for

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[301] Rysman Opening Report, ¶ 117. U.S. Horizontal Merger Guidelines, § 4.1 ("When a product sold by one merging firm (Product A) competes against one or more products sold by the other merging firm, the Agencies define a relevant product market around Product A to evaluate the importance of that competition"). By analogy in a conduct case one starts with the products that are alleged to have been effected by the conduct.

[302] *See, e.g.*, U.S. Department of Justice and the Federal Trade Commission, "Horizontal Merger Guidelines," August 19, 2010, available at https://www.justice.gov/atr/horizontal-merger-guidelines-08192010, (hereafter, "*U.S. Merger Guidelines*"), § 4 ("Market definition focuses solely on demand substitution factors … the responsive actions of supplies are also important in competitive analysis. They are considered in these Guidelines in the sections addressing the identification of market participants, the measurement of market shares, the analysis of competitive effects, and entry"); Baker, Jonathan B., "Market definition: An analytical overview," *Antitrust LJ* , Vol 74, 2007, pp. 129-173, available at https://heinonline.org/HOL/LandingPage?handle=hein.journals/antil74&div=8&id=&page=, at p 173 ("To avoid confusion and clarify the inquiry, market definition should be limited to the consideration of demand substitution; other economic forces like supply substitution can readily and appropriately be accounted for in other steps of antitrust analysis.").

[303] Baker, Jonathan, "Market Definition: An Analytical Overview," Antitrust Law Journal, No. 1., 2007, pp. 129-173, at 139 ("Accordingly, there is no reason to expect that the concept of market employed by business executives when discussing issues of business strategy or marketing, whether in testimony or documents prepared for business purposes, would be the same as the concept of an "antitrust market" or "relevant market" defined for the purpose of antitrust analysis. The informed views of executives as to the nature and magnitude of likely buyer substitution are relevant to antitrust market delineation, as discussed below, but the specifications of markets they adopt for business purposes unrelated to antitrust analysis should not control the definition of the market for antitrust purposes.").

Windows) were part of the same "ecosystem" and that Microsoft's monetization strategy for Internet Explorer (which was offered for free) could not be understood without understanding Microsoft's revenue from Windows, Office, and other products. However, that did not prevent the court from finding a distinct operating system market.[304] The OS market did not include browsers such as Internet Explorer and Netscape Navigator, even though they were linked in terms of ecosystem and monetization.[305] The reason browsers and operating systems are not in the same market is simple: browsers are not substitutes for operating systems.

      c)   In-App Billing Services and App Distribution are Complements for Developers

128.   In criticizing the separation of app distribution and in-app services, Dr. Tucker does not quantify the importance of substitution between these two markets, and she does not challenge the idea that they are complements.[306] Products are complements when the utility of a given quantity of two products is higher than the sum of having the same quantity of the products separately. That is, complementary products are more valuable when consumed together than apart.[307] An example is coffee and milk. If a consumer prefers to have eight ounces of coffee with an ounce of milk to having eight ounces of coffee by itself and an ounce of milk by itself,

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[304] *See* "Court's Findings of Fact," *United States* v. *Microsoft Corporation*, Case No. 98-1232 (TPJ), available at https://www.justice.gov/atr/us-v-microsoft-courts-findings-fact#ii, at ¶¶ II.A.1.a.

[305] *See* "Court's Findings of Fact," *United States* v. *Microsoft Corporation*, Case No. 98-1232 (TPJ), available at https://www.justice.gov/atr/us-v-microsoft-courts-findings-fact#ii, at ¶¶ II.B.1.

[306] As noted above, Dr. Tucker briefly discusses the possibility of consumer substitution by consumers in ¶ 376, but this "substitution" is not substitution between products. In my Opening Report, I explained that developers view Android App Distribution and Android In-App Billing Services as complements. *See* Rysman Opening Report, ¶¶ 192, 251.

[307] Samuelson, Paul, "Complementarity: An Essay on The 40th Anniversary of the Hicks-Allen Revolution in Demand Theory," *Journal of Economic Literature*, Vol. 12, No. 4, 1974, pp. 1255-1289.Samuelson (1974) reviews different definitions of complements. My definition is based on Equation 8 in Samuelson (1974), which he ascribes to Hicks (1932). An alternative approach would be to define complements by cross-price elasticities. However, as Samuelson (1974) points out, cross-price elasticities can be misleading in the context of multiple goods, some of which are complements and some of which are substitutes. Samuelson provides a simple example: Consider a consumer that chooses between coffee and tea and always adds milk to either. We would probably regard coffee and tea as substitutes to each other and milk as a complement to both tea and coffee. However, if the consumer always consumes more milk with tea than coffee, an increase in the price of coffee can lead to an increase in the consumption of milk, a misleading cross-price elasticity for complements.

the products are complements. Most consumers would not like the inverse: eight ounces of milk with one ounce of coffee. The two products are complements, not substitutes.

129.   The characteristics of app distribution and in-app billing services suggests that they are also complements. For both consumers and developers, the provision of in-app billing services makes apps more valuable than if apps were constrained to have all content and fees exchanged at app distribution. Similarly, in-app billing services are not even feasible without initial distribution of an app. Thus, app distribution and in-app services make each other more valuable and are complements. Antitrust relevant markets typically include substitutes, but do not need to include complements.[308] Dr. Tucker never engages with this basic point.

<div align="center">*************</div>

130.   This evidence therefore suggests it is appropriate to consider Android App Distribution and In-App Billing Services as separate markets. As explained in my Opening Report, Google has tied Android App Distribution (tying product) to In-App Billing Services (tied product).[309] Therefore, Google forces developers to purchase these two products together and pay the same commission when they sell downloads, in-app content, or subscriptions. However, as I explained in my Opening Report, In-App Billing Services is a distinct market from Android App Distribution,[310] and understanding this market is important to being able to understand the competitive effects of Google's conduct. Therefore, it is not inconsistent, despite

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[308] Markets do sometimes include complements, for example, cluster markets, which are when several product markets are studied together (*e.g.,* hospital in-patient services). *See, e.g.,* Baker (2007) at p. 158 ("The cluster market approach is inappropriate for market definition because clusters include products and services that are not demand substitutes (or supply substitutes). It can be defended as a matter of analytical convenience: there is no need to define separate markets for a larger number of individual hospital services, for example, when market shares and entry conditions are similar for each, or when data limitations will effectively require that the same proxy (such as the number of hospital beds) be employed to estimate the market share for each individual service.") Cluster markets are sometimes justified because "sellers offer buyers substantial transaction cost saving from one-stop shopping," *see* Baker (2007) citing to Ian Ayres, *Rationalizing Antitrust Cluster Markets*, 95 YLJ 109 (Nov. 1985). However, as I explained in my Opening Report, developers have alternatives for in-app billing services and would use them when given a choice. *See* Rysman Opening Report, ¶¶ 245-249 and 252-259.

[309] Rysman Opening Report, § VIII.A.2.

[310] Rysman Opening Report, § V.D.2.

Dr. Tucker's claims,[311] to use the same commission when analyzing the two markets, since that is how Google structures the price it charges to developers in the actual world.

131.   Moreover, my Opening Report is explicit that my SSNIP analysis asked "whether the market is broader than App Distribution and In-App Billing Services on Android."[312] But there is no contradiction between finding that the market is no broader than these two markets together and analyzing the markets separately as narrower markets for the purposes of understanding Google's market power and the competitive effects of the alleged conduct.[313] My SSNIP analysis shows that my two proposed markets are not too narrow.[314] My further qualitative analysis of evidence of separate demand shows that the two markets are separate.[315]

2.   Dr. Tucker's Proposed Facilitation of Digital Content Transactions Market is Overly Broad

132.   Dr. Tucker's stance on the relevant product market is overly broad. She states that the "relevant product is the facilitation of digital content transactions."[316] As stated, it is not restricted to mobile computing or even household customers. For instance, enterprise customers make digital content transactions when they purchase a new module in Salesforce or Oracle, or purchase software as a service on cloud platforms such as Microsoft Azure or Amazon Web

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[311] *See* Tucker Report, ¶ 379.

[312] Rysman Opening Report, ¶ 223.

[313] U.S. Merger Guidelines § 4.1.1. I also discuss this in the context of Dr. Tucker's claims regarding the relevant geographic market in § III.E.

[314] Rysman Opening Report, § V.C.5.

[315] Rysman Opening Report, § V.D.2.

[316] Tucker Report, § III.B.1. While Dr. Tucker does not use the term market, this appears to be her suggested relevant product market. In ¶ 9, Dr. Tucker states the product definition slightly differently, that "the product in this case is the facilitation of digital content transactions—paid and unpaid—between users and developers." Adding the concept of users and developers to the definition does not rule out the examples I provide here. Third-party software developers exist for platforms such as Salesforce, Azure, and Amazon Web Services. The data center housing the New York Stock Exchange can provide data feeds to other exchanges, who might be thought of as developers in this context. *See e.g.,* Salesforce, "appexchange," https://appexchange.salesforce.com/appxStore?type=App&d=cta-body-promo-85. Microsoft, "App Service," available at https://azure.microsoft.com/en-us/products/app-service/#overview. Amazon, "What is SaaS," available at https://aws.amazon.com/solutions/saas/.

Services.[317] High-frequency traders make digital content transactions when they purchase a data feed from the New York Stock Exchange.[318] It is unclear why Dr. Tucker would include these transactions in the relevant market for the Google Play Store, or how we could read her definition to exclude them.

133.   Although Dr. Tucker provides a clear statement of her definition of the geographic market, she fails to do so for the product market and, as written, provides an indefensibly large relevant product market. The appropriate starting place for market definition is the products relevant to the alleged conduct, and from there market definition proceeds by adding products to the extent there is sufficient demand substitution to warrant their inclusion.[319] This is the process that I followed in my Opening Report, and Dr. Tucker reverses the usual process in her analysis.

134.   Dr. Tucker's reliance on the concept of an ecosystem to define markets seems to contribute to her overly broad definition of the relevant product. For example, it is obvious that the Android ecosystem includes the Android operating system,[320] and indeed, she claims that operating systems should be in the relevant market.[321] Typically, an operating system operates a device, such as a mobile phone, and provides an interface for an application, such as an app store, to manipulate output such as the screen and speaker. Dr. Tucker does not explain how an operating system could substitute for an app store or vice versa.

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[317] *See, e.g.*, *"*What Does Salesforce Do?," Salesforce, November 16, 2022, available at https://www.salesforce.com/blog/what-does-salesforce-do/?bc=OTH and "What is AWS?," Amazon Web Services, available at https://aws.amazon.com/what-is-aws/.

[318] *See* "Data & Tech," New York Stock Exchange, available at https://www.nyse.com/data-and-tech

[319] Rysman Opening Report, § V.A.1.

[320] Tucker Report, ¶ 34: "mobile operating systems are one component of competition between ecosystems."

[321] Tucker Report, ¶ 324: "Indeed, the fact that Plaintiffs' expert reports use the same evidence regarding users' switching between Apple and Android devices to define both the licensable OS market and the app distribution market suggests that these are not separate markets but rather that both the OS and the app store are part of one ecosystem that consumers are choosing." Note that she refers here to other Plaintiffs' expert reports, as I do not define a licensable OS market.

135.   Even more striking is that Dr. Tucker appears to include physical mobile phones as part of the Android ecosystem.[322] Dr. Tucker does not define what she means by "digital transactions," in her statement about the product market definition, but surely, mobile phones are not digital transactions. Thus, although she criticizes plaintiffs' experts for defining relevant markets that divide up the "ecosystem," she contradicts herself by dividing up the ecosystem herself.

3.   Dr. Tucker's Criticisms of the Android In-App Billing Services Market are Incorrect

136.   Dr. Tucker criticizes the Android In-App Billing Services Market, because she claims that users can buy digital content outside of the Google Play Store, such that this is a substitute for in-app billing services. She also claims that by focusing on average spending, I have ignored important differences across users, and she claims that the billing services market is only a market for payment processing.

137.   Dr. Tucker points to the fact that users can make payments outside of the Google Play Store, such as by being directed to or going to a developers website, web-application, or other platform.[323] I have addressed whether substitution to these other channels is likely to constrain the hypothetical monopolist of Android App Distribution or Android In-App Billing Services, or for that matter Google, in Sections III.B and III.C. She states that "[m]any users may still prefer to pay via the Google Play store but that may simply reflect consumer preferences for the security and controls it offers rather than any evidence of friction associated with payments on other platforms."[324] But that is not evidence that Google lacks market power or that a hypothetical monopolist in this market would be constrained from raising price by a SSNIP. The

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[322] Tucker Report, ¶ 323: "By building the Android ecosystem and providing handset manufacturers with a high-quality operating system that is freely available, Google has enabled handset manufacturers as part of that mobile ecosystem to effectively compete with the Apple's tightly interconnected ecosystem, providing a foundation for interactions between digital content users and developers."

[323] Tucker Report, ¶ 406.

[324] Tucker Report, ¶ 406-407.

In-App Billing Services market is a one-sided market with developers as the buyers.[325] If Google offers a product that developers need because users value the product, that creates market power for Google or the hypothetical monopolist. Therefore, those preferences are exactly what is relevant to market definition.

138.   Dr. Tucker also claims that because my SSNIP analysis is based on average spending it ignores certain high value users who might be more sensitive to a change in app prices.[326] However, as I explained in SectionIII.C.1.a), her analysis of switching across phone price bands only shows that Android users who switch to iPhone are likely to have switched to a more expensive phone.[327] Further, Dr. Tucker provides no other convincing evidence that high value users are more likely to switch than other users. It may be the case that they are more locked into their chosen smart mobile devices brand, and potentially less willing to deal with frictions that might arise if developers tried to steer them to make purchases elsewhere.

139.   Dr. Tucker also claims that I have failed to consider post-download services that Google provides in my proposed markets.[328] This is not correct. The services Dr. Tucker cites— "fixing bugs, patching security issues, importing redesigns or launching new features"—are offered equally for free apps and paid or freemium apps alike.[329] ████████████████████

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██ [330] Developers might prefer to push their own app updates directly to users, and Dr. Tucker does not appropriately consider whether Google's mandatory insertion of itself into app updates is something any developer values, let alone at a 30% commission.

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[325] *See* Rysman Opening Report, § V.D.3.
[326] Tucker Report, ¶ 415.
[327] Tucker Report, Table 8.
[328] Tucker Report, ¶¶ 382-83
[329] Tucker Report, ¶ 382
[330] *See* DiVento (Google) Deposition, pp. 72-73 ████████████████████████
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140.   Dr. Tucker incorrectly claims that I say that the market for billing services is just payment processing,[331] but I explained in my Opening Report that at the core of in-app billing services is an SDK or API that helps enable the payment for and unlocking of in-app content, which may be offered in a bundle of complementary services that can include invoicing, payment history, refund processing, and subscription renewal services.[332]

E.   Dr. Tucker's Claims that the Relevant Geographic Market is the United States Does Not Alter My Opinion of the Relevant Geographic Market

141.   In my Opening Report, I conclude that the relevant geographic market within which to assess Google's challenged conduct is worldwide (excluding China).[333] ███████

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███[334] I also find that billing service providers offer their services worldwide (including Adyen, PayPal and Stripe), with the Google Play Store distributing apps in over 135 countries (with developers using Google Play Billing in countries where it is available).[335]███████████████████████████████

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██████ (other apps stores are instead popular, including Tencent My App, 360 Mobile Assistant, and Baidu Mobile Assistant, who use different billing service providers including AliPay and WeChat Pay).[337]

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[331] Tucker Report, § VI.C.2. and ¶ 378.

[332] Rysman Opening Report, ¶ 238.

[333] Rysman Opening Report, §§ V.C.6 and V.D.5.

[334] Rysman Opening Report, ¶ 232.

[335] Rysman Opening Report, ¶ 275.

[336] *See, e.g.*, Square, "International Availability," https://squareup.com/help/us/en/article/4956-international-availability (accessed Dec. 17, 2022) ("Card payment acceptance with the Square app is currently available in the US, Canada, Australia, Japan, the United Kingdom, Republic of Ireland, France and Spain. We currently don't support payment card processing outside of these countries . . .").

[337] Rysman Opening Report, ¶ 233 & ¶ 276.

142.   By contrast, Dr. Tucker contends the Google Play Store competes in a narrower geographic market limited to the United States.[338] Dr. Tucker's conclusion is based on the fact that "[a]pp stores are generally designed for users in specific countries who generally speak a particular language, use a particular currency and have particular interests"[339] as well as "country-specific or region-specific competitive conditions and constraints" for users and developers.[340] Google's at issue conduct is worldwide (excluding China) and therefore this is the starting place for my analysis of geographic market definition.[341]

143.   Dr. Tucker also does not grapple with the possibility that focusing on demand-side substitution when undertaking geographic market definition risks defining markets too narrowly. For example, when discussing geographic segmentation for telecommunications markets, the OECD acknowledged that "[a] consumer is unlikely to move to another geographic area due to a price increase (or degradation of quality) since the cost of re-location will probably far outweigh any saving made on fixed-line services. Hence, geographic demand-side substitution is usually a weak constraint so that if this approach were pursued it would lead to very narrow markets being defined that would be impractical to analyze."[342]

144.   In addition, despite arguing for a narrow U.S. market, Dr. Tucker cites data and evidence corresponding to a worldwide (excluding China) market. For example:

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[338] Tucker Report, § VII.B.

[339] Tucker Report, ¶ 420.

[340] Tucker Report, ¶ 431.

[341] *See e.g.* Rysman Opening Report, ¶¶ 232 and 275.

[342] OECD, "Geographically Segmented Regulation for Telecommunications," *OECD Digital Economy Papers*, No. 173, at p. 19.

[343] Tucker Report, ¶ 211 and footnote 341.

- Dr Tucker cites Sensor Tower data that in 2020 showed "81% of worldwide (excluding China) app downloads from both the Google Play store and the Apple App Store were made via the Google Play store, but consumer spending on the Google Play store accounted for only 43% of consumer spending on the two stores."[344]

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145.   Nonetheless, my conclusions on Google's monopoly power in the Android App Distribution Market do not hinge on whether the market is worldwide (excluding China) or a narrower market focusing on the United States. My Opening Report frequently provided evidence of Google's market power in the United States, in addition to evidence of worldwide market power in my proposed markets. For example:

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[344] Tucker Report, ¶ 211.
[345] Tucker Report, footnote 451.
[346] Tucker Report, footnote 452.
[347] Tucker Report, ¶ 271.
[348] Rysman Opening Report, Exhibit 35.

- My comparison of Google's supracompetitive commission in the Google Play Store to various competitive benchmarks are all relevant for the U.S. market (e.g., Microsoft Store's 15% commission and Epic Games' Store commission of 12%);[349]

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  and

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146.   Similarly, evidence that suggests that Google has monopoly power in the worldwide (excluding China) Android In-App Billing Services Market applies similarly to a narrower U.S. geographic market:

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[349] Rysman Opening Report, ¶ 288.
[350] Rysman Opening Report, ¶ 289 and Exhibit 37.
[351] Rysman Opening Report, ¶ 302.
[352] Rysman Opening Report, ¶ 303 and Exhibit 40.
[353] Rysman Opening Report, Exhibit 43.
[354] Rysman Opening Report, ¶¶ 318 - 326.
[355] Rysman Opening Report, ¶¶ 348 - 352.

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IV.   Google has Monopoly Power in the Relevant Antitrust Markets

A.   Overview

147.   In my Opening Report, I presented a market power analysis, following standard methods in antitrust economics, in which I presented both direct and indirect evidence demonstrating Google has monopoly power in the relevant antitrust markets.[357]

148.   By contrast, Google's expert Dr. Tucker claims that Google does not have market power, a finding derived from her overly broad definition of a relevant market, and she presents various criticisms of the market power analysis offered in my Opening Report. Dr. Tucker criticizes my calculation of Google's market share on the basis that the Android App Distribution and In-App Billing Services Markets are defined too narrowly[358] and contends that, because it is *possible* for the barriers to entry created by indirect network effects to be overcome, Google does not benefit from the market power those indirect network effects confer.[359] Dr. Tucker also claims that a proper interpretation of Google's commission rate would lead to the conclusion that Google faces competitive constraints[360] and further asserts that it is wrong to interpret Google's high margins as indicative of market power.[361] Finally, she contends Google's innovation and expanding output in the Google Play Store are evidence that Google does not have monopoly power.[362]

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[356] Rysman Opening Report, § IV and ¶ ¶ 357 - 360.

[357] Rysman Opening Report, § VI.

[358] Tucker Report, § VIII.H.

[359] Tucker Report, § VIII.E.

[360] Tucker Report, § VIII.C. and § VIII.D.

[361] Tucker Report, § VIII.I.

[362] Tucker Report, § VIII.F. and § VIII.G.

149.   I have considered Dr. Tucker's criticisms, and, as I explain below, I find her criticisms are without merit. In particular:

- Dr. Tucker's analysis of Google's commission compared to other app stores and over time does not account for the fact that only a small proportion of Google Play Store's revenue has been affected, and when discussing the declining price she fails to take into account whether the competitive price may also have fallen over the same period. Her analysis also fails to account for the impact of increased regulatory scrutiny on Google's commission. I explain in more detail issues with her analysis of Google's commission rate in Section IV.B.1.

- In Section IV.B.2, I explain that when analyzing output and innovation over time, Dr. Tucker also fails to establish a competitive benchmark and instead relies on Google's actual output and innovation, thereby making her analysis uninformative.

- Next, as I explain in Section IV.B.3, while Dr. Tucker claims that barriers to entry from network effects could be overcome under certain conditions, her analysis is focused on the potential for these barriers to be overcome and does not show they actually have been overcome or that this potential was sufficient throughout the period to discipline Google.

- Her structural analysis suffers from her overly broad market definition and is therefore not relevant, as I explain in Section IV.D.

- Finally, in Section IV.B.4, I explain how her claims that Google's margins do not reflect all of the costs associated with the broader Android ecosystem or the costs that were required for Google to innovate simply reflect her incorrectly broad definition of the relevant market.

- I also address Dr. Tucker's claim that sideloading, pre-installation, and alternative app stores limit Google's market power (*see* Section IV.C).IV.C

150.   I conclude that Dr. Tucker's criticisms do not change my opinion that Google has monopoly power in Android App Distribution and Android In-App Billing Services. I review the most salient issues in Dr. Tucker's analysis below.

B.   **Dr. Tucker Misinterprets Evidence Related to Google's Market Power**

1.   *Similarity in Pricing Across App Stores and Over Time is Not Evidence of Restraints on Google's Market Power*

151.   Dr. Tucker claims Google, and other App stores have charged similar prices and have discounted prices in response to each other's pricing decisions.[363] ▮▮▮▮▮▮▮▮▮

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▮▮▮▮▮▮▮▮▮▮▮▮▮▮.[364] However, there are several additional inconsistencies in Dr. Tucker's evidence. For example, Dr. Tucker suggests that "Google's service fee rate has declined over time" and that "[t]his evidence is inconsistent with the claim that Google has monopoly power."[365] But a downward trending price in isolation does not suggest an absence of market power. What matters is the price relative to the competitive price (which may not be static over time and could have fallen faster and farther).[366] The fact that Google's commission remains above those of its most relevant competitors is an indicator of market power.[367] Moreover, when Google's commission rate has declined, the price reductions came after or around the time of related private and public enforcement actions such as this case; thus, any price reductions do not indicate a response to competitive pressures but instead a response to increasing regulatory and legal scrutiny.[368] Dr. Tucker does not even mention the pendency of these investigations as a factor relevant to her analysis.

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[363] Tucker Report, *see e.g.,* ¶¶ 452-4727, Table 10 and Table 11.

[364] Rysman Rebuttal Report Backup Production. *See also* Rysman Opening Report, Exhibit 35.

[365] Tucker Report, ¶ 454.

[366] *See e.g.*, a paper cited by Dr. Tucker notes that "[i]f the competitive price is known, then a comparison of the prevailing market price and the competitive price will allow a direct inference about market competitiveness." Klotz, Thomas J., "Monopoly Power: Use, Proof and Relationship to Anticompetitive Effects in Section 2 Cases," Working Paper, 2008, pp. 1-42, at pp. 14-15.

[367] See Rysman Opening Report, Exhibit 69.

[368] Rysman Opening Report, ¶ 286.

152.   Dr. Tucker also suggests that one should "compare Google's service fee rates for the Google Play store to the rates charged to sell other products, including products that require a substantial amount of innovation and creativity by the firms that develop them" and that "[o]ther digital content distribution platforms charge fees that are equal to or higher than Google's service fees for the Google Play Store."[369] These include Amazon Prime Video Direct, Kindle, and Nook, which charge fees in the 30-65% range, and Apple iTunes which charges 27-37%.[370] However, while all these examples may be within Dr. Tucker's overly broad market, the production process and demand for books, movies, and music may be different from apps and, thus, these may not be comparable benchmarks and Dr. Tucker does not provide a detailed analysis that would establish these products as comparable. Further, I note that Dr. Tucker's analysis of service fees (as present in Dr. Tucker's Table 10) includes the Samsung Galaxy Store (30%) and the Amazon Appstore (20% for <$1m, 30% for >$1m, and 20% for movie and TV subscriptions).[371] However, a deeper analysis of these headline commission rates shows small competitors can be much more aggressive with discounts off the headline rates. In Exhibit 5, below I compare Google's average commission rates (across paid app downloads, in-app digital content and subscriptions), with Amazon Appstore and Samsung Galaxy Store's net commission rates (*i.e.,* net of any discounts developers receive off the headline rates).

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[369] Tucker Report, ¶ 460.

[370] Tucker Report, ¶ 460.

[371] Tucker Report, Table 10.

Exhibit 5
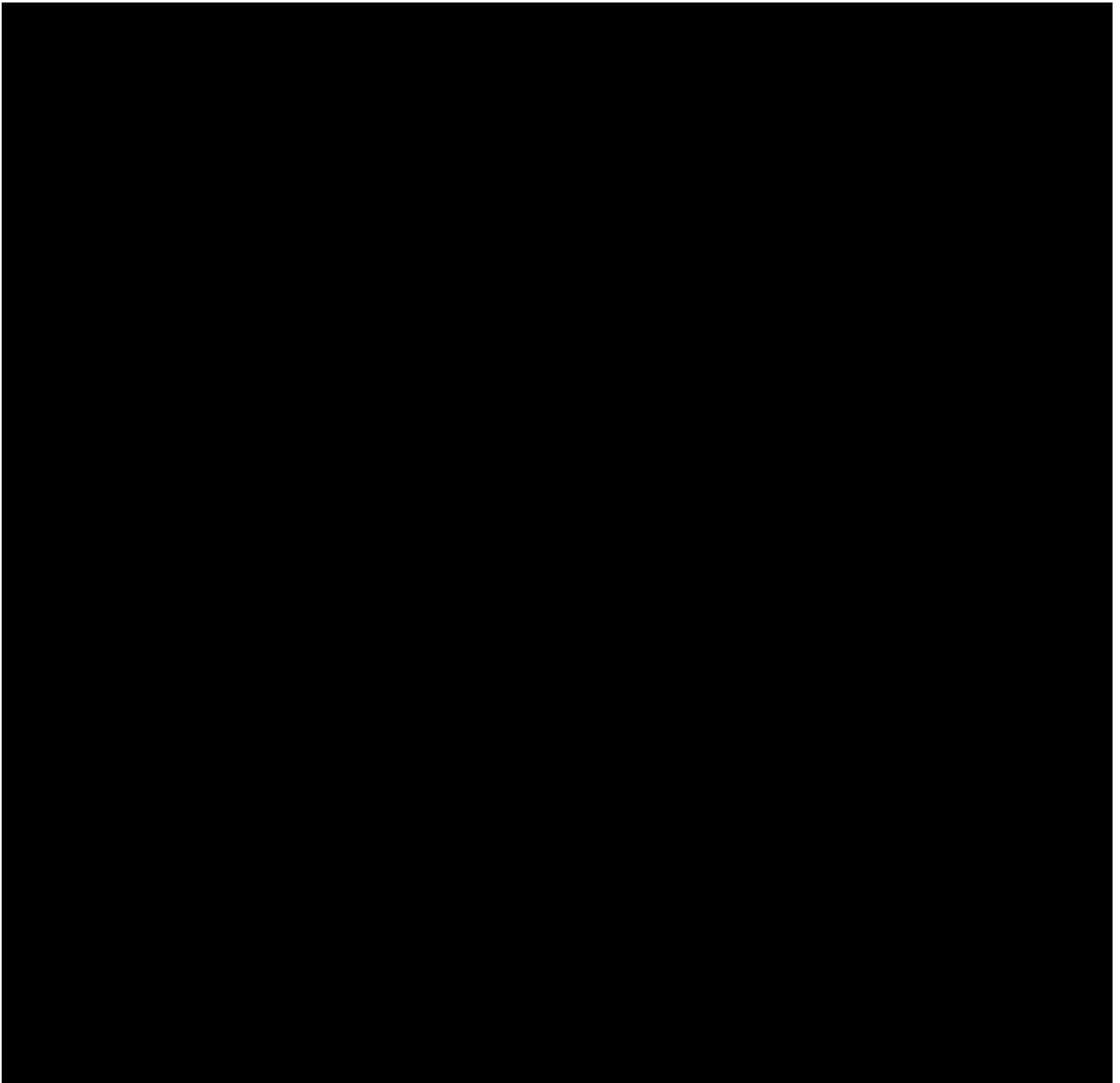
Sources:

1. Rysman Production, Exhibit 35.
2. ████████████ 1.
3. ████████████████

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suggests that the headline rates used by Dr. Tucker are misleading and a full analysis needs to account for the discounts developers received from smaller app store competitors.

154.   Dr. Tucker also says that Google charged a 30% commission when Google did not have market power.[372] However, Dr. Tucker does not explain why Google's prices were higher at launch than competitors such as SlideME and potential Android App Distribution entrants such as Qualcomm.[373] ███████████████████████████████████
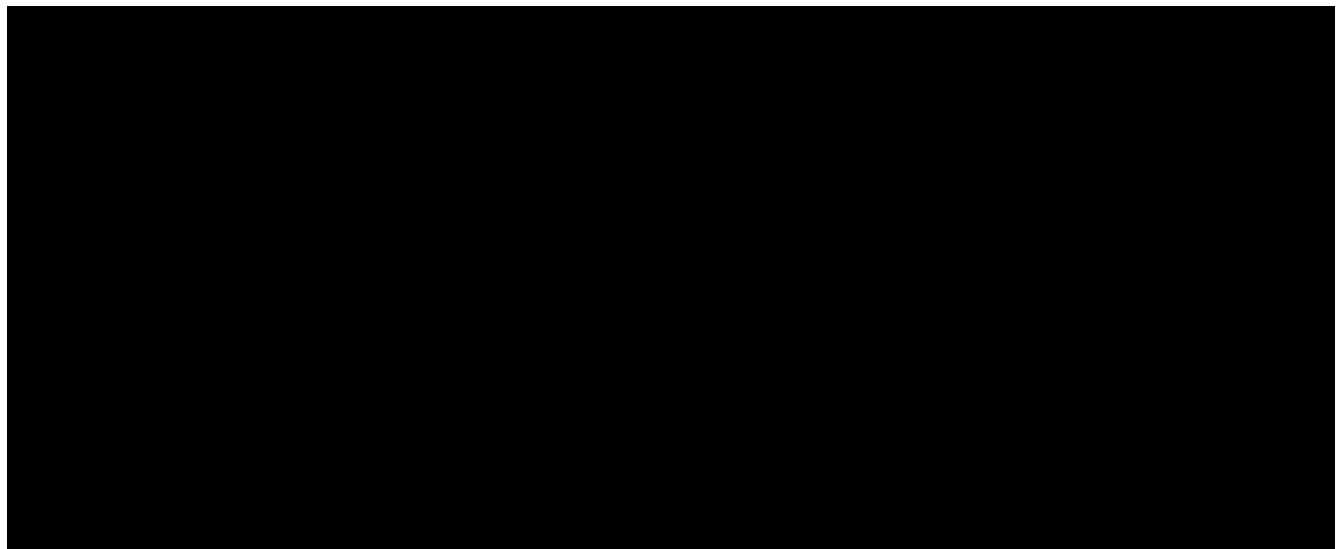
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Exhibit 6

Sources:

1. ████████████████ Deposition, p. 32:8-9 ███████████████████████████████
████.

2. ████████████████ Deposition, pp. 34-36 █████████████████████████████
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3. "Qualcomm sees growth for Brew MP despite rivals' success," available at
https://www.mobileworldlive.com/latest-stories/qualcomm-sees-growth-for-brew-mp-despite-rivals-success
("Rob Chandhok, president of Qualcomm's Internet Services division, said the two platforms are targeting very
different markets. "Brew MP and Android really aren't competitive – they are really in different tiers," he said.")

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[372] Tucker Report, ¶ 454.

[373] *See* Exhibit 6 below.

4. See ████████ Deposition, p. 29 ██
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5. ████████ Deposition, p. 30 ██
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6. Play Console Help, "Service fees," available at https://support.google.com/googleplay/androiddeveloper/answer/112622

7. Rysman Opening Report n.571 (citing Google, "Android Market: Now available for users," October 22, 2008, available at https://android-developers.googleblog.com/2008/10/android-market-now-available-for-users.html and Chu, Eric, "In-app Billing Launched on Android Market," Android Developers, March 29, 2011, available at https://android-developers.googleblog.com/2011/03/in-app-billing-launched-on-android.html#:~:text=Today%2C%20we're%20pleased%20to,purchases%20from%20within%20your%20apps.).

8. SlideME, "A Brief History of the Android App Store Race," (Feb. 16, 2009), http://slideme.org/blog/brief-history-android-app-store-race ("On October 23rd, [2008,] SlideME releases SAM, our mobile client for the G1. Google still has their Android Market closed to the general developer community, so we see a spike in content stocked at SlideME, as well as G1 users hungry for new apps that aren't on the Android Market."). SlideME, "Release of SAM 2.3 and Support for Paid Applications," (Feb. 9, 2009), http://slideme.org/blog/slideme-release-sam-23-and-support-paid-applications ("SlideME is pleased to announce support for paid applications with our release of SAM 2.3, the first billing solution for Android that includes a mobile client.").

9. SlideME, "Release of SAM 2.3 and Support for Paid Applications," (Feb. 9, 2009), http://slideme.org/blog/slideme-release-sam-23-and-support-paid-applications ("SlideME is pleased to announce support for paid applications with our release of SAM 2.3, the first billing solution for Android that includes a mobile client.").

10.   *See* ████████████████ Deposition, pp. 209-210 ████████████████████████████
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██ ; SlideME, "Release of SAM 2.3 and Support For Paid Applications," (Feb. 9, 2009), http://slideme.org/blog/slideme-release-sam-23-and-support-paid-applications (advertising "[h]igh payout rates to content providers/developers ~98%"); SlideME, "SlideME Revenue Share," (Sept. 30, 2009), http://slideme.org/blog/slideme-revenue-share ("At SlideME, we introduced the highest payouts for developers in the industry, with typical payouts of 95%. The remaining 5% went directly to the payment processor. Our position has always been not to make money on downloads."). I understand that, beginning with this second press release, SlideME began charging a typical commission of 20% for direct carrier billing and 20% plus $0.10 for other forms of payment, which was equal to Google's commission at the $1 mark and lower than Google's commission for any price above that at this time. *See* SlideME, "Rate Schedule," available at http://slideme.org/rate-schedule.

11.   Christopolous Deposition, pp. 215-16 ████████████████████████████████████
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12.   Qualcomm, "App Store Pioneer to Take Mobile Retailing to Any Device on Any Network with Plaza Retail," (May 17, 2009), *available at*: https://www.qualcomm.com/news/releases/2009/05/app-store-pioneer-take-mobile-retailing-any-device-any-network-plaza-retail.

13.   ████████████████ Deposition, pp. 34-36 ████████████████████████████████████
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14.   F-Droid, "F-Droid Is Here," (Sept. 29, 2010), https://f-droid.org/2010/09/29/f-droid-is-here.html ("F-Droid is dedicated to Free and Open Source (FOSS) software on the Android platform.").

15.   Because F-Droid "is an installable catalogue of FOSS (Free and Open Source Software) applications for the Android platform," I understand that it by definition does not include paid apps and therefore, there is no commission on the sale of paid apps or in-app content that F-Droid collects. F-Droid, "What is F-Droid?," https://f-droid.org/en/ (accessed Dec. 17, 2022). "F-Droid is a non-profit volunteer project" that solicits donations. F-Droid, "About," https://f-droid.org/en/about/ (accessed Dec. 17, 2022). I understand that F-Droid permits free apps to offer paid in-app content but does not offer its own in-app billing solution. *See* F-Droid, Forum, In-app Purchases (Sept. 2015), https://f-droid.org/forums/topic/in-app-purchases/.

155.   Dr. Tucker also mentions that I did not highlight Aptoide's competitive positioning, where Aptoide states that developers "[g]et a minimum of 75% payout rate on in-app purchases in comparison to 70% or even 50% you get with other app distributors," which Dr. Tucker suggests "highlights the existence of higher service fees than the 30% service fee for the Google Play store."[374] But Dr. Tucker cites only Aptoide's marketing material on their website and she does not provide any examples of app stores charging those rates.[375]

156.   Finally, I would note that comparisons in my Opening Report to benchmark commission rates should be viewed as only one of several factors on which I base my conclusions about Google's market power.

2.   *Dr. Tucker's Analysis of Output and Innovation Fails to Compare Google's Conduct with a Competitive But-for World*

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██[376] Dr. Tucker also cites to various improvements that Google has made to the Play Store as evidence of innovation.[377] These analyses fail to demonstrate that Google lacks market power in the relevant markets. There are many reasons why output may have increased in the actual world, but what is important is that it may have increased faster in a competitive world where Google had less market power or did not

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[374] Tucker Report, ¶ 472.

[375] See, Aptoide, "Distribute apps to over 300M users," available at https://en.aptoide.com/company/developers.

[376] Tucker Report, ¶ 516.

[377] Tucker Report, § VIII.F.

actively suppress competition. An appropriate analysis of whether Google has market power based on output would need to determine if Google's output reflected the competitive level, not just whether it changed or even increased over time. Even monopolists can be expected to innovate and improve their products, but they may have less incentive to innovate than in a more competitive marketplace. I discuss in more detail the problems with Dr. Tucker's analysis below.

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███████████████████████████████████████[378] Dr. Tucker offers no analysis that shows output in 2012 represents a competitive benchmark for the relevant markets. In my Opening Report, for instance, I found that in 2012 Android's share of the Licensable Smart Mobile OS market was nearly 90% worldwide excluding China (or 96% in the U.S.[379] This evidence suggests that 2012 may not be a valid *competitive* benchmark for output for the Play Store, even accepting the notion that Android OS shares are a relevant measure of Google's power in my proposed markets (and they are not).

159.　Dr. Tucker's analyses of spending and purchases overtime are also not compelling because they do not control for various other changes that have occurred during this time period. In particular, they do not control for increases in the demand for Android App Distribution of In-App Billing Services that arise for reasons outside of Google's control. As noted in my Opening Report the share of Americans who own a smartphone has increased from 35% to 85% from 2011 to 2021.[380] Some of the increase in spending on Play Store must be attributed to an expanding userbase. Further, not all measures of output have been uniformly expanding over the same time period. ██

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[378] Tucker Report, Figures 44-47.

[379] Rysman Opening Report, ¶¶ 37 – 40, and Exhibits 2-5.

[380] Rysman Opening Report, ¶ 30.

████████████████████████[381] Therefore, it cannot be concluded that Google lacks market power based on the increase in consumer spending over time.

160.   In fact, as I explained in my Opening Report, in a more competitive market where Google charged a lower commission, a model of competition in the relevant markets indicates that the number of unique apps would have been 20% higher, over the period from August 16, 2016 to May 31, 2022.[382] ████████████████████████████████

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[381] Rysman Opening Report, Exhibit 46 and 47.
[382] Rysman Opening Report, ¶ 488 and Appendix F E.11.

Exhibit 7
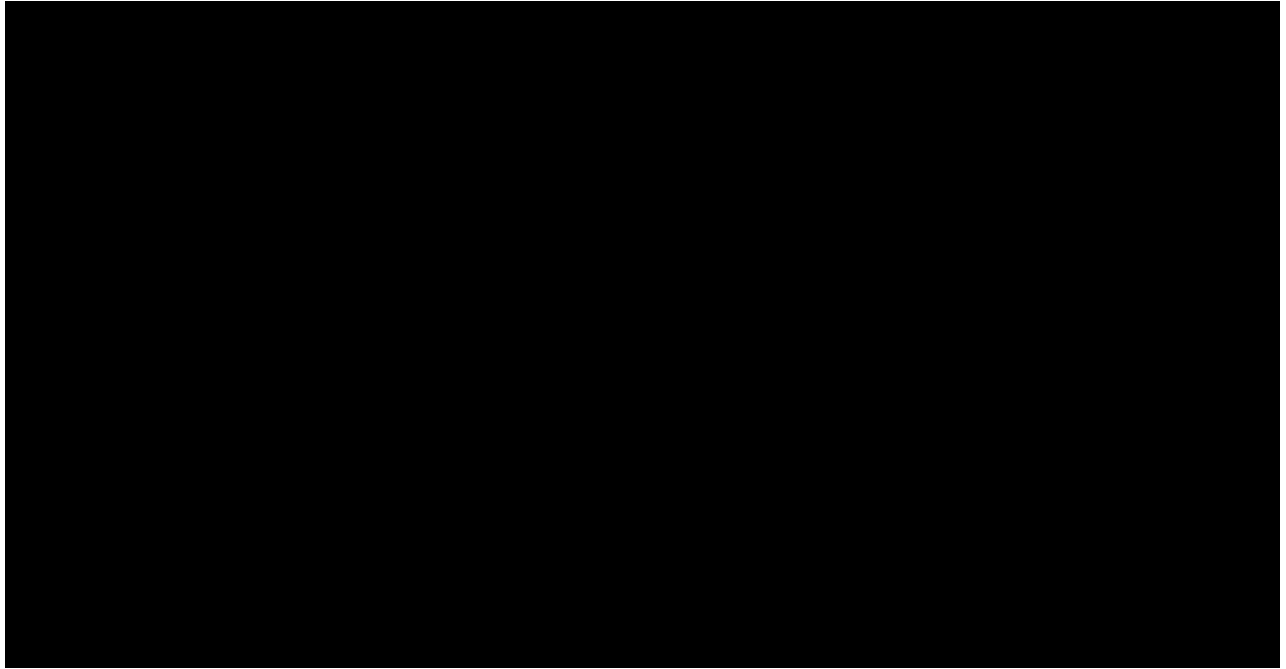
Notes:

1. See Rysman Opening Report, Appendix F where I develop a model underlying my damages calculations. The model provides a mechanism through which the lower commission translates into an increased supply of unique apps and in-app content.

2. This estimation was performed under the assumption that both the number of apps changes but the price of apps does not change in response to a change in the commission.

Source: Google Transactions Data.

Exhibit 8
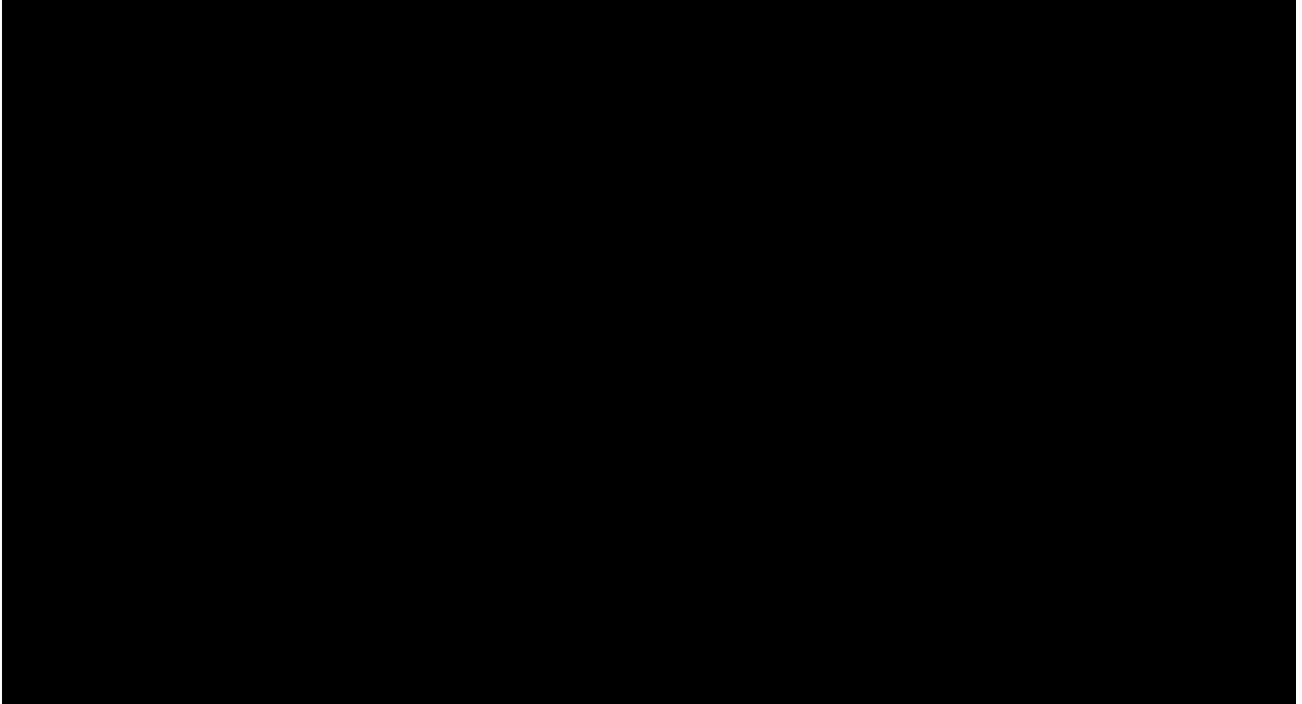
Notes:

1. *See* Rysman Opening Report, Appendix F.
2. This estimation was performed under the assumption that both the number of apps and price of apps changes in response to a change in the commission.

Source: Google Transactions Data.

161.   Dr. Tucker's arguments regarding innovation suffer from the same basic issues as her arguments regarding output. She does not compare Google's level of innovation to that which would have occurred in a competitive but-for world. I discuss Google's innovation further in Section V.G.1 when I discuss harm and competitive effects.

3.   Contrary to Dr. Tucker's Claims, Network Effects Do Create Barriers to Entry

162.   In my Opening Report, I argue that the Play Store benefits from network effects, which create a barrier to entry to new app stores.[383] App stores are attractive to consumers in part because of how many apps they offer and are attractive to developers in part because of how many consumers shop there. New app stores find it difficult to reach comparable scale because of this circular dynamic or "chicken and egg" problem. The basic theory of network effects is widely understood in economics and clearly recognized by industry participants in markets with operating systems and app stores.[384]

163.   Dr. Tucker's attempt to undercut the argument that network effects create a barrier to entry, fails to recognize important elements of the markets under study.

164.   Dr. Tucker's apparent position that barriers to entry need to be insurmountable to confer market power colors her analysis of the academic literature on network effects. She argues that multi-homing "mitigate[s]" the importance of network effects.[385] She argues that "localized" competition "**can** impose competitive constraints on platforms [emphasis added]."[386] And Dr. Tucker says that network effects "**can also** lead to negative feedback loops [emphasis added]."[387] However, in each case, these claims do not go so far as to say that network effects are made irrelevant as potential barriers to entry by these factors, only that there are ways that barriers to entry from network effects **can** be mitigated.

165.   In support of the fact that the "winner take all" aspect of platforms are mitigated when platform users multi-home, she cites to Armstrong (2006), which studies two configurations, "both groups single home" and "one group single-homes while the other multi-

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[383] Rysman Opening Report, ¶¶ 318-326.

[384] Rysman Opening Report, § V.A.2.

[385] Tucker Report, ¶ 498.

[386] Tucker Report, ¶ 500.

[387] Tucker Report, ¶ 502.

homes."[388] Of the two, the second is the most relevant because developers typically multi-home while consumers typically single-home.[389] Armstrong terms this setting "competitive bottlenecks" and finds that it gives the platform "monopoly power" over the "multi-homing side" because they must use the platform to access the "single-homing" customers.[390] Armstrong's model finds that this leads to "high prices being charged to the multihoming side, and there will be too few agents on this side." This prediction directly contradicts Dr. Tucker's position that multi-homing would mitigate Google's market power.[391]

166.   Dr. Tucker seems to have in mind that both users and developers multi-home as her examples of Uber and Lyft, and American Express, Visa, and MasterCard all have this feature.[392] As evidence for multi-homing, Dr. Tucker cites to analyses of gaming platforms that she does in Section V.C. of her report. I do not dispute that many developers will develop apps for multiple platforms, but the evidence presented in my Opening Report indicates that users do not tend to multi-home across multiple smart mobile device ecosystems.[393] Also if we focus on gaming, as Dr. Tucker does, it is not clear that multi-homing across gaming platforms is possible for many games or common for users more broadly than in the few examples, ▓▓▓▓▓▓▓, that Dr. Tucker cites in her report.[394] ▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓

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▓▓▓▓▓▓▓▓▓[395] There are likely many mobile app and mobile game developers that

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[388] Tucker Report, ¶ 498 and footnote 946.

[389] Rysman Opening Report, ¶ 46.

[390] Armstrong, Mark, "Competition in two-sided markets," *The RAND Journal of Economics*, Vol. 37, No. 3, 2006, pp. 668-691(hereafter "Armstrong (2006)") at p. 669.

[391] Another paper she cites Liu et al. (2022) points out that "specific homing patterns of buyers and sellers do not automatically lead to specific market outcomes because one also has to take into account multihoming users' preferences for transacting on certain platforms and not others." Liu, Chunchun, Tat-How Teh, Julian Wright, and Junjie Zhou, "Multihoming and oligopolistic platform competition," forthcoming in *American Economic Journal*, 2022, pp. 1-49, at p. 2.

[392] Tucker Report, ¶ 499.

[393] Rysman Opening Report, ¶¶ 46 and 330.

[394] Tucker Report, § V.C.3.

[395] Tucker Report, Figure 28.B.

would not be interested in reaching consumers on these platforms. I discuss gaming platforms and multi-homing in more detail in Section III.C.4 and III.C.1.a)of this report.

167.   Dr. Tucker argues that "'localized' competition" can create a constraint on Google, by which she means gaming platforms competing with Google Play.[396]I explain elsewhere that gaming platforms are not in the relevant market, and even if they were, they are not relevant during the entire period under review.[397] Setting aside whether gaming platforms are in the relevant market, her argument related to "'localized' competition" does not make sense. She provides a convoluted story of how competing against gaming platforms could cause Google to "invest both in transactions supported by the 'localized' competitor and other transactions on the platform."[398] That is, "localized" competition can cause all participants on a platform to experience the benefits of competition. She does not provide any examples of what investments Google has made in response to gaming, and she notably leaves Google's commission out of her analysis. It is obvious from the record that Google can offer a discount on its commission to sensitive developers and continue to charge high prices to the rest of the developers.[399] That is, even under the most favorable interpretation, "localized" competition has not displaced Google as a platform and cannot do so, and has not led Google to lower its commission for "non-local" participants, who remain subject to the market power due to network effects.

168.   Dr. Tucker also provides examples of apps that experienced network effects but that were eventually displaced by other apps. At best, this establishes that network effects are not insurmountable, about which there is no debate.

169.   Finally, I would also add that network effects were a significant concern regarding a potential challenge from carriers. An email from Tom Moss (Google's head of Japan New Business Developer) to Andy Rubin in 2009, stated, "[i]f we can get carriers comfortable with Market for the near future, there will come a tipping point where consumer demand will be

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[396] Tucker Report, ¶ 500.

[397] *See* § III.C.4. Rysman Opening Report, ¶¶ 200-210.

[398] Tucker Report, ¶ 501.

[399] Rysman Opening Report, ¶ 286, and Tucker Report, Table 3.

so strong we can set different revenue models and carriers will be unable to compete with their own offerings because their own offerings will be so limited in comparison."[400] This suggests that Google knew that network effects would create a tipping point for its market power, beyond which carriers would find it difficult to complete.

4.   Google's Margins Are Evidence of Market Power

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████████████████████████████[401] Further, she argues that because Google is innovating and incurring significant fixed costs operating the Google Play Store, it is not appropriate to infer monopoly power from its margins.[402]

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████████████████████████████[404] As I explained in my Opening Report, "[w]hile accounting profits can deviate from economic profits and it is important to

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[400] Email from Tom Moss, Google, to Andy Rubin, Former Google VP and Android Founder, "Subject: Re: Your thoughts on Android Market," February 3, 2009, GOOG-PLAY-001423609-610, at 609.

[401] Tucker Report, ¶ 531.
[402] Tucker Report, ¶ 535-536.
[403] Tucker Report, ¶ 531.
[404] Rysman Opening Report, Exhibit 38.

consider other evidence, I find that Google's high accounting margins are consistent with the other evidence I provide of Google's market power."[405]

172.   In addition, Dr. Tucker argues that the Google Play Store's margins are not specific to Android App Distribution or Android In-App Billing Services markets.[406] However, Google has protected/extended this market power by tying in-app billing services to app distribution. Therefore, the Google Play Store's margins (which includes the In-App Billing Services Market), is a relevant indicator of Google's market power in app distribution. I would also note that Dr. Tucker does not quantify what in her view would be the correct margins for measuring Google's market power in any proposed market. Finally, Dr. Tucker contends that the Plaintiff experts "do not accurately capture Google's early losses on Android."[407] T█████████
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173.   However, accounting for these losses during the period I analyze in my Opening Report (2013-2021) makes limited difference to the operating profits. ███████████████
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[405] Rysman Opening Report, ¶ 297. *See also* Rysman Opening Report, ¶ 294, explaining how high margins are evidence of a firms ability to set prices above a competitive level.

[406] Tucker Report, ¶ 532.

[407] Tucker Report, ¶ 541.

[408] Tucker Report, ¶ 541.

[409] Google, "Android OC Quarterly Review - Q2 2010," July 12, 2010, GOOG-PLAY-001490474- 493, at 478; Google, "Android OC Quarterly Review – Q2 2011," July 26, 2011, GOOG-PLAY-005570952.R-972.R, at 958.R.

[410] Tucker Report, ¶ 541.

Exhibit 9
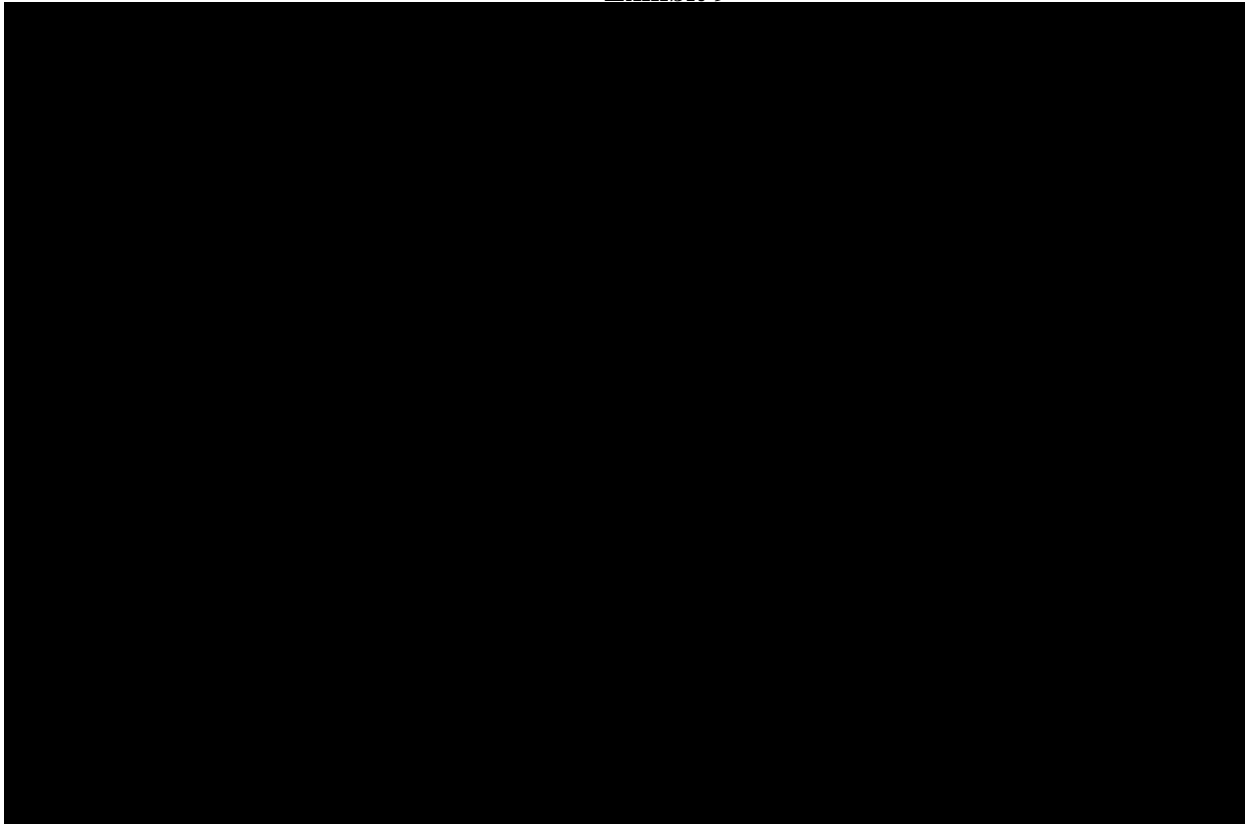
Source: See Rysman Opening Report, Exhibit 38 and accompanying notes/sources; Tucker Report, ¶ 541.

174.   Finally, I note that Dr. Skinner asserts that "Google Play internal management P&Ls do not fully reflect the joint and common costs of those Alphabet resources that benefit Google Play" and that "[n]one of Plaintiffs' expert economists address this factor."[411] He also claims that "the available evidence suggests that these additional costs are substantial."[412] However, the preceding analysis already demonstrates that re-allocating the earlier losses (likely due to investment in the Google Play Store) makes a negligible impact on Google's operating profit margin. To allocate the other "additional costs benefiting Google Play" that Dr. Skinner calls substantial, he does not quantify these joint / common costs or allocate them to the Play Store with any detailed analysis. Moreover, Dr. Skinner does not propose what in his view

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[411] Skinner Report, ¶ 173.

[412] Skinner Report, ¶ 173.

should be the correct profit margins on which to assess Google's market power.[413] I therefore maintain my opinion that Google's margins are consistent with the other evidence I provide of Google's market power.[414]

C. Sideloading, Pre-Installation, and Alternative App Stores Do Not Constrain Google's Market Power in the Relevant Markets

175.   Dr. Tucker suggests there are other ways the Google Play Store competes for users and developers to transact digital content, including pre-installed apps, sideloaded apps and alternative apps stores.[415]

176.   First, Dr. Tucker suggests that the ability of developers and users to sideload apps is a "competitive feature of the Android ecosystem" and that "numerous Android users and developers use sideloading."[416] ███████████████████████████████████

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███ [417] As I explain in further detail in Section V.E.3, these statistics are misleading and focus only whether **at least one** app on a user's device was sideloaded.[418] This does not show how frequently Android users actually use sideloading as an alternative to the Play Store.

177.   Second, Dr. Tucker notes that there are "numerous Android app stores in addition to the Google Play Store," including "handset manufacturer app stores such as the Samsung Galaxy Store and Xiaomi GetApps and third-party app stores such as Amazon Appstore, as well

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[413] Skinner Report, § VIII.A.1.

[414] Rysman Opening Report, ¶ 297.

[415] Tucker Report, ¶ 251.

[416] Tucker Report, ¶ 271.

[417] Tucker Report, ¶ 271.

[418] ███████████████████████████████████

██████████████████████████████████ *See* Tucker Report, ¶ 392. I discuss this data and why my use of it was appropriate in § V.E.3.

as APKMirror, APKPure and F-Droid."[419] ███████████████████████

████████████████████████████████████[420] Dr. Tucker does

not provides any market share estimates for these other stores; indeed, their market share is

constrained by the challenged Google conduct, and the various measures of Google Play's

market share I provide in my Opening Report refute the notion that these other app stores

meaningfully constrain Google in the status quo. ████████████████████

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██████████████████████████.[421] ████████████████████

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█████[423] APKMirror does not offer paid apps or support for in-app billing[424] and, because it is

web-based, is subject to the "unknown sources" warning the first time a user seeks to download

an app from their website using a particular browser on an Android smart mobile device.

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[419] Tucker Report, ¶ 253.

[420] Rysman Opening Report, ¶ 154.

[421] Google, ██
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[422] Rysman Opening Report, ¶¶ 51, 151 footnote 351, 319 footnote 673, 413, 427, 432, 459-462, 508. *See also*
Google, ██████████████████████" March 17, 2016, GOOG-PLAY-004494298.R-325.R, at 317.R
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██████████████████████████ Email from Christian Cramer, Google, to Kristin Reinke, Google, ██████████
██████████████████████ July 8, 2017, GOOG-PLAY-009209478 █████████████████
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██████████████████ June 2017, GOOG-PLAY-000571992-040, at 011, 014, and016 ██████████
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[423] Rysman Opening Report, ¶¶ 400-407.

[424] APKMirror, "FAQ," available at
https://www.apkmirror.com/faq/#Does_APKMirrorcom_host_paid_or_pirated_apps (explaining that
"APKMirror.com has a no-piracy policy and does not host paid apps," with some "rare exceptions" for updates to
paid apps in beta testing);

178.   Third, Dr. Tucker's data on pre-installed apps is misleading.[425] ██████████

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██.[427] However, these metrics just show

that these stores are available on a user's device, not that Android users are visiting them or

making purchases there. Dr. Tucker fails to provide any evidence that these apps stores are

constraining the Google Play Store. I discuss the issues with studying the share of Android

devices with alternative app stores in detail in Section V.E.2

179.   Dr. Tucker also presents Table 6, which shows that "of the top 20 apps by Google

Play store U.S. consumer spending on in-app payments and subscriptions in 2021, 80% were

also available on the Amazon Appstore."[428] ████████████████████████████████████

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██.[430] I would also note that

Amazon's very small pre-installation share is consistent with Google's exclusionary policies (see

further Section V.E.2).[431]

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[425] Tucker Report, ¶¶ 271, 392, and footnote 759. See also, Gentzkow Report, ¶ 188 and footnote 221.

[426] Tucker Report, ¶ 256.

[427] Tucker Report, ¶ 254. Gentzkow Report, ¶ 183. Dr. Tucker's number is for the U.S. in December 2018. Dr. Gentzkow's figure is worldwide in 2021.

[428] Tucker Report, ¶ 255 and Table 6.

[429] Rysman Opening Report Exhibit 40.

[430] Rysman Opening Report Exhibit 40.

[431] Dr. Hoffman has claimed that my conclusions regarding limited switching between Apple and Android rely on the Presser Survey.[431] I understand that Dr. Presser will respond to the criticisms of the survey he devised. In any event, my conclusions do not depend on Dr. Presser's results. As set out in my Opening Report, I rely on numerous surveys and other data sources suggesting that switching costs are high and there is limited switching among mobile OSs. See, Rysman Opening Report, § V.C.4.

D.   Dr. Tucker Calculates Shares in Overly Broad Markets

180.   After concluding that Apple, website digital transactions, web apps, consoles and PC game stores should all be in the relevant market, Dr. Tucker naturally calculates low market shares for Google.[432] However, for the reasons mentioned above in Section III.C, Dr. Tucker's evidence does not suggest these alternatives should be in the relevant market, let alone provide a sufficient constraint on Google's behavior.

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██████████████████████[433] ███████████████████████████

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████████████████████[434] Dr. Tucker does the same equivalent calculations for gaming and notes: "[i]f I include the consumer spending on digital transactions through the PlayStation Store, Nintendo Store, and Epic Games Store discussed above, then the Google Play store's share of global consumer spending in gaming transactions would fall to 34%."[435] Again she does not provide sufficient evidence that these alternatives provide a constraint on Google in the Android App Distribution Market (see Section III.C above), and her alternative share calculations should therefore be dismissed.

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[432] Tucker Report, § VIII.H.

[433] Tucker Report, ¶ 523.

[434] Tucker Report, Table 5.

[435] Tucker Report, ¶ 528.

V.   Harm to Competition & Competitive Effects

A.   Overview

182.   Dr. Gentzkow presents an analysis of Google's challenged conduct and responds to certain elements of the analysis presented in my Opening Report. His analysis of Google's conduct relies on standards that likely find very little conduct anticompetitive. In his analysis of Google's prices, Dr. Gentzkow asserts that Google's commission satisfies five factors indicating it is an "effective" price structure.[436] This five-factor test seems manufactured to justify Google's conduct and. In evaluating Google's challenged conduct, he considers each element of Google's challenged conduct separately, separately assessing the anticompetitive and procompetitive effects of each and ignoring the anticompetitive impact of Google's challenged conduct as a whole.[437] Dr. Gentzkow contends that "availability" of alternative app distribution channels is sufficient to find there is no harm to competition,[438] regardless of the quality or access of these alternatives and despite the fact that Google's conduct has effectively foreclosed each of these alternatives. He offers explanations for Google's behavior based on economic efficiency that are speculative and unsupported, and at odds with evidence I present below. And he claims without evidence that users and developers *could* be worse off in the but-for world.[439] Finally, the limited empirical evidence he does present is inconsistent, flawed, and misleading.

183.   I have considered Dr. Gentzkow's own assessment and his criticisms of my analyses, and, as I explain below, I find his assessment and criticisms are largely flawed, misguided, or irrelevant, demonstrated by simple adjustments to his analyses. Therefore, Dr. Gentzkow's criticisms do not alter my opinion that Google has engaged in conduct that has harmed competition and consumers in the Android App Distribution and Android In-App Billing

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[436] Gentzkow Report, § IV.F.

[437] Gentzkow Report, §§ VII (████████, VIII ████████ IX (████████), X (████████), XI ████████, XII (Security safeguards), XIII (DDA provision), and XIV (Google Play Billing requirement).

[438] Gentzkow Report, § VI.A.

[439] Gentzkow Report, § XVIII.

Services Markets. I review the most salient issues in Dr. Gentzkow's analyses and criticisms below.

> **B.   Dr. Gentzkow's Claim that a Large Share of Users and Developers Could Be Worse Off in the But-For World is Speculative and, In Any Event, Not a "Procompetitive" Justification**

184.   In the final section of his report, Dr. Gentzkow summarizes his findings by saying that "the evidence taken as a whole suggests that consumers would plausibly be worse off in a but-for world where the challenged conduct was absent."[440] Yet, in the very next sentence he admits that "[p]recisely quantifying welfare in that but-for world is challenging."[441] A but-for world analysis holds all other conduct constant and looks at how things are different in the absence of the challenged conduct. I address the evidence that leads him to the conclusion that a large share of users and developers could be worse off in the but-for world.

185.   First, Dr. Gentzkow states "[t]here is no guarantee that any reductions in Google's service fee would be passed on to users. Plaintiffs' experts conclude that this kind of pass-through would likely be large."[442] However, I do not opine on the level of reductions in Google's commission that would be passed on. My model is robust to different pass-through rates and, in fact, the damages number I put forth is for the case of no pass-through. Dr. Gentzkow writes as if the lack of pass-through would mean consumers are not harmed. However, as I show in my Opening Report, if the service fee is not passed on, then developers absorb the effect of high service fees, which forces them out of business and reduces the variety of apps available to consumers.[443]

186.   Second, Dr. Gentzkow suggests, without evidence, that "[w]hatever alternatives Google was able to find to address collective action problems on Android would likely be less effective than the current contracts, and the health of the ecosystem could suffer as a result,"

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[440] Gentzkow Report, ¶ 635.
[441] Gentzkow Report, ¶ 636.
[442] Gentzkow Report, ¶ 639.
[443] Rysman Opening Report, ¶¶ 560-563.

including "more fragmentation across devices, lower quality apps, and/or more free riding," which could lead to a "significant deterioration of the platform."[444] However, as I discussed in Section 0 below, for example, consumers do not value Google controlling app stores entirely, as evidenced by the low market share of the Google Pixel "out-of-the-box experience" smartphone and the lack of discussion of Google's control in reviews of the Pixel.

187.   Third, Dr. Gentzkow claims that "reducing or eliminating Google's ability to monetize its investments through a service fee paid by profitable app developers would lead it to change its conduct on other dimensions that could hurt users and app developers" and that "[i]n a but-for world where the ability to earn revenue through service fees was reduced or eliminated, Google's incentives to support the ecosystem would be weakened and users and app developers would likely suffer as a result."[445] Yet, as discussed below, a change in Google's commission rate would have a limited impact on its ability to invest in the Android ecosystem because Google Play Store revenues are a small share of Android revenues.

188.   Finally, Dr. Gentzkow points to the situation in China and the downfall of Symbian as "a vivid illustration of what a world without Google's current conduct might look like."[446] However, as mentioned below, Gentzkow provides no evidence or analysis to suggest that the Android App Distribution Market without Google's anticompetitive conduct would suffer the same fate.

C.   I Do Not Need to Specify the Precise But-For World Outcomes to Find that the But-For World is More Competitive than the Actual World

189.   Dr. Gentzkow's interpretation of the standard required in evaluating a world absent anticompetitive conduct imposes a level of precision that is not necessary to demonstrate harm to competition and consumers. He claims:[447]

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[444] Gentzkow Report, ¶ 640.
[445] Gentzkow Report, ¶ 637.
[446] Gentzkow Report, ¶ 641.
[447] Gentzkow Report, ¶ 66 (emphasis added).

To assess the economic effects of allegedly exclusionary conduct, it is necessary to compare outcomes in the actual world to outcomes in a but-for world where the challenged conduct is absent. This requires (i) defining <u>precisely</u> what forms of conduct would be prohibited in the but-for world; (ii) analyzing what forms of permitted conduct the firm in question as well as other market participants would undertake in the but-for world (consistent with their own economic interests); (iii) comparing outcomes such as prices, output, and welfare in the but-for world to those in the actual world.

190.   Dr. Gentzkow's claim that I needed to specify the exact outcomes of the but-for world is wrong as a matter of economics. Regarding his three criteria, I specified (i) and performed (iii) in my Opening Report. His claim that (ii) is required to assess the economic effects of allegedly exclusionary conduct is wrong. Intuitively, an economist that knows the demand curve and price can calculate quantity and consumer surplus without specifying exactly the market shares of each supplier. That is the approach I take in the context of Google's commission rate and consumer and developer demand.

191.   He further opines in the very next paragraph of his report that because "the but-for world where the at-issue conduct is absent is generally not observable . . . outcomes in this world *must be inferred from theory and empirical evidence*."[448] And he explains that these challenges are "particularly large in the case of network and platform markets, where changes on one side of the market can have large" effects on the other side.[449] Indeed, this statement supports my opinion that the RSA 3.0 agreements can meaningfully foreclose competition from competing app stores. A smaller foreclosed share of the market, which may be insufficient to demonstrate harm to competition in a one-sided market, may be sufficient to forestall competition in two-sided markets because indirect network effects imply that a loss of share on one side results in a corresponding loss of share on the other side, causing a negative feedback loop. Dr. Gentzkow evaluates conduct in isolation and frequently on a single side only, failing to account for the "sometimes counterintuitive spillover effects" between two-sided platforms that he says must be considered in the but-for world.[450]

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[448] Gentzkow Report, ¶ 67 (emphasis added).

[449] Gentzkow Report, ¶ 67.

[450] Gentzkow Report, ¶ 67.

192.   Moreover, Dr. Gentzkow does not contest that, without Google's anticompetitive behavior, there would be more competition. He only quibbles that I do not explain exactly *how* there would be more competition. In other words, Dr. Gentzkow does not disprove that, in the but-for world, Google's commission would be lower or the quality of the Play Store would be improved or the variety of apps available in the Android App Distribution Market would be greater. My Opening Report is careful not to take a position on what the competitive but-for market structure would look like. Perhaps there would be multiple app stores specialized in different categories, or several broad app stores covering overlapping sets of apps, or perhaps Google will continue to have high market share but with lower fees and more apps.

193.   Thus, as a matter of economics, my Opening Report shows that it is sufficient to identify an upper bound on the competitive commission that would be realized in the but-for world to calculate counterfactual output, prices, number of apps, and consumer damages. It is not necessary to specify what new entrants in app distribution there would be, or what market shares they would realize. It is a strength of my approach that it is robust to different possibilities.[451] Indeed, my approach is conservative in the sense that I ascribe all of the benefits of competition to lower commissions and the resulting effect on the variety of apps. In general, economists believe that competition leads to other benefits, such as enhanced innovation, variety, and specialization. Overall, I do not see the why an economist would need the specificity that Dr. Gentzkow requires.

194.   Further, Dr. Gentzkow's claims above consider a but-for world that removes the entirety of one type of Google's contract, for each contract individually. First, as I discuss in Section V.D.1 below, I do not claim that the entirety of Google's contracts are anticompetitive; rather, I call out certain elements of these contracts that collectively, with other conduct such as

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[451] Related to this, Dr. Gentzkow incorrectly describes my model as a monopoly model of app distribution (Gentzkow Report, ¶ 609). To support this, he provides a general reference to my model section even though I never state that it is a monopoly model, nor do I solve the model as one would for a monopolist. In my model, consumers consume apps. App stores provide access to these apps. Whether there are many app stores or a single app store and whether each app store carries all apps or just a subset is unimportant in my model. As a group, app stores provide access to all apps. I do not model the specific decision of which app store a consumer chooses to consume which app from. Rather, I directly model the choice of the consumer of app consumption.

imposing technological hurdles to sideloading, harm competition by foreclosing alternative Android app distribution channels. Thus, a but-for world analysis is not one that considers the absence of each contract separately; instead, it is one in which Google's collective anticompetitive conduct, which is represented in parts of each contract, is absent.

195.   Finally, focusing on the proper question of what the but-for world looks like with respect to Google's conduct in the first instance in my but-for world, the conduct listed on pages 92 and 93 of my Opening Report never happens. Where necessary to respond to particular procompetitive justifications, I propose less restrictive alternatives from Google's actual conduct that could have resulted in the same or similar procompetitive benefits. This helps show whether the conduct is necessary to achieve the purported benefit. However, I do not need to specify which combination of these less restrictive alternatives Google, in fact, would have adopted in the but-for world. It is enough to show that the challenged conduct is not necessary to realize the procompetitive benefits, which in turn demonstrates that the anticompetitive effects outweigh the procompetitive benefits.

D.   Dr. Gentzkow's Analysis of Each Type of Google Contracts and Conduct in Isolation is Misleading

1.   Dr. Gentzkow Ignores the Collective Impact of Google's Conduct

196.   In Section V.A above and in Section IV.C of my Opening Report, I summarized Google's conduct that enabled it to monopolize Android App Distribution and then use its monopoly power to tie the use of Google Play Billing for apps distributed through the Google Play Store. Importantly, I contend only that certain aspects of Google's relevant contracts, and not the entirety of these contracts, in combination with each other and technological hurdles Google has imposed, are anticompetitive and collectively caused harm to competition and consumers. Dr. Gentzkow, nonetheless, considers each Google contract in its entirety and separately from the other contracts/conduct, evaluates my individual contentions regarding each

contract in isolation, and ignores the collective impact of Google's challenged conduct on competition and consumers.[452]

197.   As I explained in my Opening Report, Google's contracts and conduct work together to create barriers and foreclose competition.[453] Google adapted its behavior throughout the period under study to restrain competition as it perceived it. Thus, by evaluating each contract or conduct in isolation, Dr. Gentzkow fails to see the harm to competition that Google's conduct as a whole has created.

198.   Evaluating the harm as a whole is supported by the literature. For example, Crane (2010) notes that "aggregating a monopolist's disparate acts in order to determine liability makes perfect sense," particularly when "the legality of the defendant's conduct turns on whether it forecloses a significant share of the relevant market."[454] Crane (2010) then concludes that "there are undoubtedly some cases in which legality should turn on an analysis of the effects of the conduct, *taken as a whole*."[455]

199.   Google, too, evaluated the impact of its agreements as a whole, a fact Dr. Gentzkow ignores. ███████████████████████████████

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[453] Rysman Opening Report, ¶ 363.

[454] Crane, Daniel A., "Does Monopoly Broth Make Bad Soup?" *Antitrust Law Journal*, vol. 76, no. 3, 2010, 663-676, at p. 670.

[455] Crane, Daniel A., "Does Monopoly Broth Make Bad Soup?" *Antitrust Law Journal*, vol. 76, no. 3, 2010, pp. 663-676, at pp. 674-675 (emphasis added).

[456] *See* Google, █████████████████████████ GOOG-PLAY-000443763.R-798.R, at 766.R-769.R774.R. *See also* Google, █████████████████████ December 2018, GOOG-PLAY-004708826-851.R, at 832.

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200.   I review additional criticisms by Dr. Gentzkow with respect to Google's contracts below.

a)   MADA

201.   In my Opening Report, I showed how the MADA's placement requirements and bundling of mandatory GMS apps with Google Play—and, in some cases, exclusivity clauses— disincentivized OEMs from preloading alternative app stores besides Google Play on their devices.[460] In response, Dr. Gentzkow claims to identify a number of errors in my analysis. I address them in turn below. Nothing that Dr. Gentzkow has pointed out changes my opinions or ultimate conclusions.

202.   ██

██████████████[461] As was evident, I was referring here to the EMADA and TMADA, versions of the MADA Google adopted following the European Commission's ruling against Google's Android business practices. The citation I provided in the paragraph of my Opening Report that Dr. Gentzkow cites is to the U.K. Competition and Markets Authority investigatory report into Google's mobile business practices. At the page I cite, the UK CMA report discusses "the

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[457] Google, ███████████████████████" December 2018, GOOG-PLAY-004708826-851.R, at 832.

[458] Google, ██ May 6, 2019, GOOG-PLAY4-007239946-951, at 947.

[459] Google, ███████████████ March 2019, GOOG-PLAY-000879069-073, at 072. *See also* Google, ████████████████████████████████████" GOOG-PLAY-000565846-849, at 847–848.

[460] Rysman Opening Report, § VII.A.1.

[461] Gentzkow Report, ¶ 273 (citing Rysman Opening Report ¶ 393).

revenue Google generates from the EMADA License fee" and notes that that amount is "is lower than the cost it incurs through" the RSAs.[462] ████████████████████

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[462] Rysman Opening Report, ¶ 393 & n.813 (citing CMA Final Report on Mobile Ecosystems, ¶ 3.154).

[463] Gentzkow Report, ¶ 270.

[464] Gentzkow Report, ¶ 272.

[465] Gentzkow Report, ¶34.

[466] Gentzkow Report, ¶ 273 (citing Rysman Opening Report ¶¶ 408, 414, 417); *see also* Gentzkow Report, ¶ 310 (citing Rysman Opening Report ¶¶ 408, 414).

[467] Rysman Opening Report, Ex. 61.

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[REDACTED] and demonstrate that these clarifications do not change my opinions.

206.   Fourth, Dr. Gentzkow uses the example of Huawei as support for the proposition that there is significant demand for Google apps to come in the form of the MADA bundle. In Dr. Gentzkow's telling, "Huawei was blocked from installing Google apps on its Android devices in 2019," but then sales declined after the ban went into effect.[472] However, Dr. Gentzkow did not consider that Google took steps to ensure that GMS apps would not work

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[469] GOOG-PLAY-001442316, email from Alex Medina to Patrick Brady (Sept. 12, 2012) [REDACTED]
[REDACTED]
[470] Gentzkow Report, ¶ 273.
[471] Rysman Opening Report, Ex. 62.
[472] Gentzkow Report, ¶ 277.

on Huawei devices even when sideloaded by Android users. ████████████████

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208.   Dr. Gentzkow concludes the MADA does not substantially harm competition.[477]

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[473] Email from Paul Bankhead (Google) to Paul Gennai (Google), ████████████████████" February 13, 2020, GOOG-PLAY-004537618-621, at 620.

[474] Miyake (Google) Deposition, pp. 107 ████████████████████████████████

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████████; *see also* Google, ████████████████████████████████

████████████ July 13, 2017, GOOG-PLAY-011461351-353, at 351 ████████████████

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[475] Gentzkow Report, ¶¶ 287-288.

[476] Gentzkow Report ¶ 287.

[477] Gentzkow Report, § VIII.C.

[478] ████████████████████ Deposition, pp. 50-51, 55-57.

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██ *See* Dury (GetJar) Deposition, p. 61

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████████████████ [480] For all these reasons, I conclude that elements of the MADA, in combination with the other challenged conduct, created anticompetitive effects that outweigh the procompetitive justifications proffered by Dr. Gentzkow, which are either minimal, provided for by more competitive means, or both.

b)   Early RSAs

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████████████████ [482] Dr. Gentzkow makes several mistaken claims about this evidence.

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[480] Rysman Opening Report, ¶¶ 383 & 432, and footnote 893.
[481] Rysman Opening Report, ¶¶ 369-374.
[482] Rysman Opening Report, ¶ 374.
[483] Gentzkow Report, ¶ 36.
[484] Rysman Opening Report, § VI.

NON-PARTY AND PARTY HIGHLY CONFIDENTIAL – OUTSIDE COUNSEL EYES ONLY

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████ He incorrectly assumes carriers would not have incentive to support Android OS without payments related to the app store, but carriers had incentive to attract users to their networks and provided phone deals to do so.[488]

213. ██

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[485] Gentzkow Report, ¶ 321; *see also id.* ¶ 317.

[486] Rysman Opening Report, ¶ 374.

[487] Gentzkow Report, ¶ 322.

[488] Apple, "Apple Chooses Cingular as Exclusive US Carrier for Its Revolutionary iPhone," January 9, 2007 https://www.apple.com/newsroom/2007/01/09Apple-Chooses-Cingular-as-Exclusive-US-Carrier-for-Its-Revolutionary-iPhone/; Repko, Melissa, "Apple Chooses Cingular as Exclusive US Carrier for Its Revolutionary iPhone," The Dallas Morning News, September 12, 2017.

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214.   He also makes similar claims about foreign wireless carriers, noting that "LG U+ had 20 percent of the South Korean market in 2014, Deutsche Telekom had approximately 33 percent of the German market in 2013,…Rogers had 34 percent of the Canadian market in 2013/2014 [and] America Movil, which operates in Latin America under different subsidiaries, had 2012 market shares under 50 percent in five of the seven countries in which it operated."[490] Dr. Gentzkow's claim that these shares show "the early RSAs did not prevent the development of alternative app stores in the years after Android was introduced."[491]

215.   Dr. Gentzkow's share calculations consider different geographies separately, though the market is worldwide (excluding China), and some shares he cites are not insubstantial, noting shares from 33 to 50%. The source for his shares of MNOs outside the U.S. shows certain regions with shares in excess of 60%.[492] Yet, he does not provide a share calculation that would consider the impact of all the MNO agreements collectively. Moreover, he also does not consider the impact of similar agreements with OEMs during that time. The question—which Dr. Gentzkow's analysis does not answer—is whether these early RSAs with both OEMs and MNOs prevented the development of alternative app stores.

c)   Later RSAs

216.   Dr. Gentzkow provides several criticisms of my analysis of Google's later RSA agreements.

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[489] Gentzkow Report, ¶ 347.

[490] Gentzkow Report, ¶ 348.

[491] Gentzkow Report, ¶ 349.

[492] GSM Association, "Mobile Telephony and Taxation in Latin America," December 2012, available at https://www.gsma.com/latinamerica/wp-content/uploads/2012/12/Mobile-telephony-and-taxation_WEB_compressed.pdf.

217. ██

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218.   I have several issues with Dr. Gentzkow's characterization of my claim. First, he misinterprets my statements. I wrote:[496]

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[493] Gentzkow Report, ¶ 375 (citing Rysman Opening Report, ¶ 387), stating "neither Dr. Rysman nor any other Plaintiffs' expert has identified RSA 3.0s with MNOs that contain such terms."

[494] Gentzkow Report, ¶ 375.

[495] Gentzkow Report, ¶ 375.

[496] Rysman Opening Report, ¶¶387-388 (internal footnotes and paragraph references in original).

[497] Google, "Let's talk about business model," GOOG-PLAY-000443763.R-798.R, at 775.R.

[498] Google, "Android Partnerships Strategy Rethink," May 6, 2015, GOOG-PLAY-001184813-857, at 823.

[499] Google and OnePlus, "Google Mobile Revenue Share Agreements," February 1, 2020, GOOG-PLAY-000416651-697, at 679.

[500] Kolotouros (Google) Deposition, p. 115 ████████████████████████████████
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219.   ██

████████████████"[501] and contends the Google source documents I cited in support for my

assumptions are also mischaracterized.[502]

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████████████████████ Days after my report was served, Google produced that data for the first

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[501] Gentzkow Report, ¶ 418.

[502] Gentzkow Report, ¶¶ 38, 418.

[503] Rysman Opening Report, ¶ 394.

[504] Rysman Opening Report, ¶¶ 397-98 & Exs. 58 & 59.

[505] Rysman Opening Report, ¶ 394 (citing to Google, ████████████████████████████

████████████████████████ May 6, 2019, GOOG-PLAY4-007239946-951, at 949.).

time. On review of that new data, ████████████████████████████████

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222.   Second, I did not mischaracterize what Google projected in its own documents.
Dr. Gentzkow points out that I had written that ██████████████████████████████

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is correct – I should have said more precisely that ████████████████████████

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████████████████████████████████[507] In any event, now that I
have actual data, (which had not been produced when I was preparing my Opening Report),
Google's projections are less important for calculating actual foreclosure.

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[506] Gentzkow Report, ¶ 418; Google, "Android Commercial Agreements," October 2020, GOOG-PLAY-011057832-886, at 845.

[507] Rysman Opening Report, ¶ 407.

[508] Gentzkow Report, ¶ 400.

[509] Google, ████████████████████████ October 2020, GOOG-PLAY-006861555.R-577.R, at 559.R.

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[510] Google ████████████████████████ October 2020, GOOG-PLAY-006861555.R-577.R, at 563.R.

[511] Google, ████████████████████████████ February 24, 2021, GOOG-PLAY-003894142-177, at 172.

[512] Google, ████████████████████████████ February 24, 2021, GOOG-PLAY-003894142-177, at 176.

[513] Gentzkow Report, ¶ 418, citing Rysman Opening Report, ¶ 394 (Google, ████████████████████████ ████ February 24, 2021, GOOG-PLAY-003894142.R-177.R. at 176.R.).

[514] Google, ████████████████████████████ February 24, 2021, GOOG-PLAY-003894142.R-177.R. at 176.R.

Exhibit 10
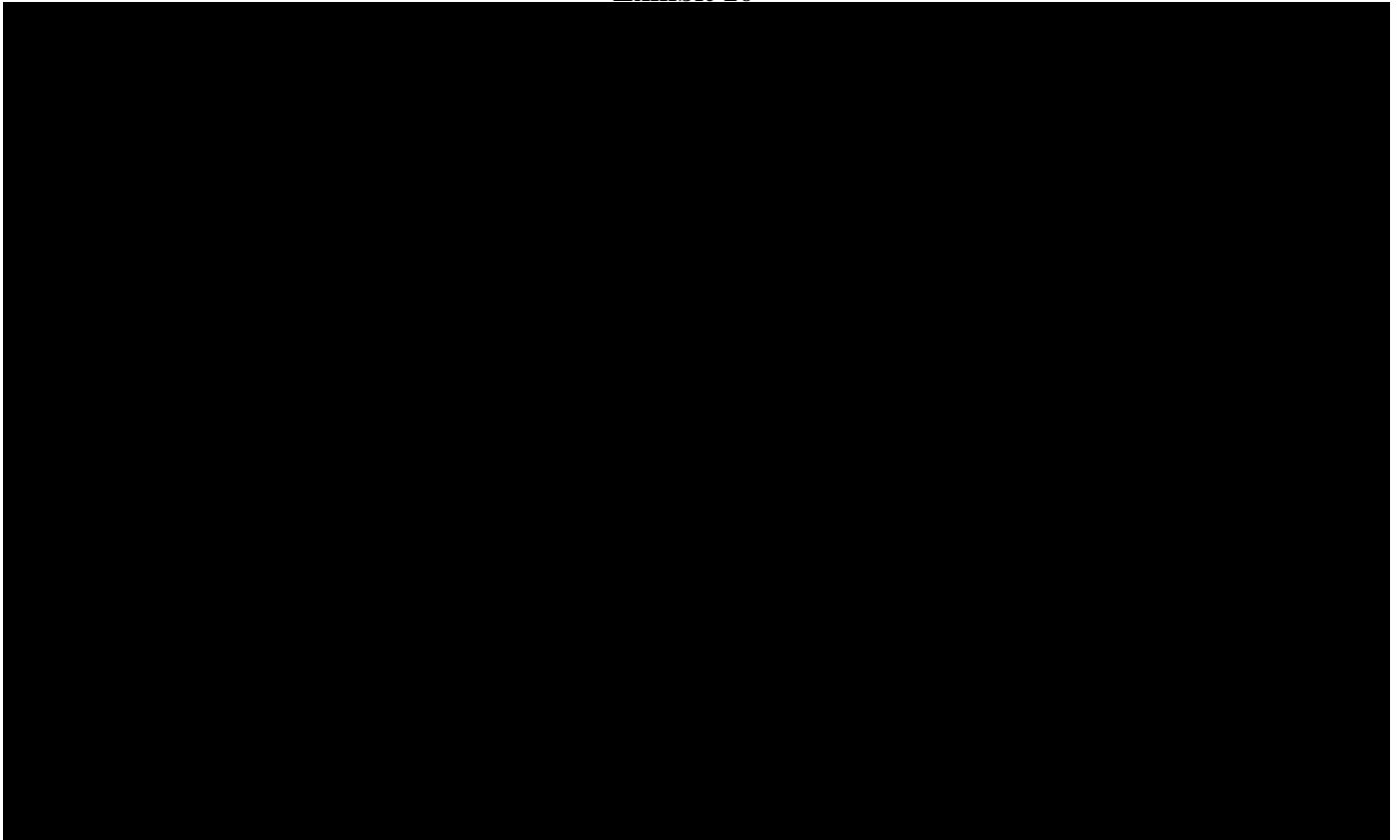
Source: Google, ████████████████████████ February 24, 2021, GOOG-PLAY-003894142.R-177.R., at 175.R.

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[515] Gentzkow Report, ¶ 37, § X.B.

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2. Dr. Gentzkow's Premier Tier Analysis Understates the Impact of Google's RSA 3.0 Agreements

226.   Dr. Gentzkow contends "the later RSAs have not substantially harmed competition" but instead "are likely to increase rather than decrease competition."[517] ██

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███████████████████████████████████████"[518] However, there are several issues with this claim. ███

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[516] Rysman Opening Report, ¶ 367. ███████████████████████████████

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██ *See* Bernheim Opening Report, ¶ 271; E-mail from Bjorn Kilburn to Jim Kolotouros, Vice President of Android Platform Partnerships at Google, ██████████████ October 3, 2015, GOOG-PLAY-001925008-010, at –5008-5009. ████████████

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██████████████████████████████████████ *See* Kolotouros (Google) Deposition, p. 159 ███████████████████████████████████████

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███████████████████████ ; E-mail from Jim Kolotouros to Bjorn Kilburn, ████████████

█████████████ October 3, 2015, GOOG-PLAY-001925008-5010 at –5008. ████████████

█████████████████████████ *See* Kolotouros (Google) Deposition, p. 151 ████████████

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██ ██████w Report, ¶¶ 394-395.

[518] Gentzkow Report, ¶¶ 396-397, 408 and Exhibit 33.

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[519] Rysman Opening Report, ¶¶ 394-395 (citing Google, ███████████████████████
████████████████ May 6, 2019, GOOG-PLAY4-007239946-951, at 949; and ██████████
████████████ October 2020, GOOG-PLAY-006861555.R, at 560.R. *See also* Google, ███████████████████
████████████ October 2020, GOOG-PLAY-006861555.R-577.R, at 568.R) and Exhibit 56. *See also* Google, ████████
██████████████████████████████████ June 2019, GOOG-PLAY-004488106.R-164.R, at 121.R.

[520] Gentzkow Report, ¶¶ 38, 369, 396.

[521] Rysman Opening Report, Ex. 58-59; Email from Christopher Li (Google) to Don Harrison (Google), GOOG-
PLAY-009436873 (May 28, 2020) ██
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[522] Google, ████████████████████████████████ GOOG-PLAY-011657415; GOOG-PLAY-
011657416; GOOG-PLAY-011657417; GOOG-PLAY-011657418; GOOG-PLAY-011657419; GOOG-PLAY-
011657420; GOOG-PLAY-011657421; GOOG-PLAY-011657422; GOOG-PLAY-011657423; GOOG-PLAY-
011657424; GOOG-PLAY-011657425.

[523] Gentzkow Report, ¶ 400 and Exhibit 34.

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████████████████████████████ *See* Rysman Opening Report, § VII.A.1.a.

[525] *See, e.g.*, GOOG-PLAY-004488106.R, at 107, 109.

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████████████████████████████ *See* Rysman Rebuttal Report Workpapers.

NON-PARTY AND PARTY HIGHLY CONFIDENTIAL – OUTSIDE COUNSEL EYES ONLY
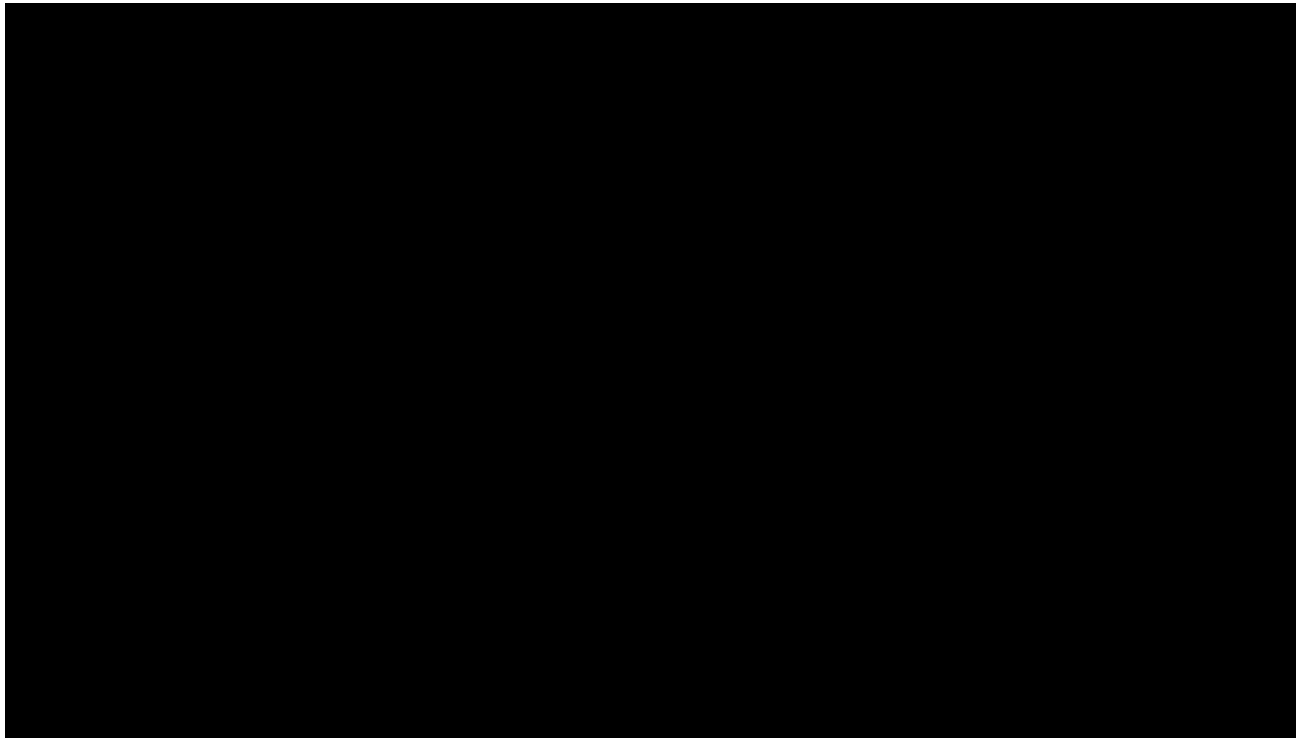
Exhibit 11

Source: Gentzkow Backup Production.

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[527] Rysman Opening Report, ¶ 398 and Exhibit 58.

[528] Google, ████████████████████████████████████ June 2019, GOOG-PLAY-
004488106.R-164.R, at 121.R

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3. Dr. Gentzkow Overlooks Important Elements of ████████████

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██████████████████████████████[533] But Dr. Gentzkow fails to acknowledge that a firm's ability to engage in price discrimination requires market power. ████████████████████████████████████

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[529] Rysman Opening Report, ¶ 365,

[530] Gentzkow Report, ¶ 427.

[531] Gentzkow Report, § XI.A, ¶ 427.

[532] Email from Lawrence Koh, Former Director and Global Head of Games Business Development at Google, to Google Personnel, ██ February 13, 2020, GOOG-PLAY-007035840-843, at 840.

[533] Gentzkow Report, ¶ 39; see also ¶ 428, § XI.B ████████████████████████████████ ██ ████████████████

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████████████████. What he calls competition on the merits fits the standard description of

exclusive dealing. Foreclosure through exclusive dealing is not defined by buyers getting nothing

in return from a seller; it is when a large seller signs exclusive deals with buyers preventing them

from creating market share for a rival.[534]

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██[535] But a key way

for alternative app stores to compete with the Google Play Store, especially given its dominance,

is to offer something unique to users. ██

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E.   Dr. Gentzkow Fails to Show that Competition Was Not Foreclosed

1.   Dr. Gentzkow's Claim that App Developers Reach Users through Many Channels Focuses on "Availability"

236.   Dr. Gentzkow claims that "[c]ompetition for transactions between users and app

developers has not been foreclosed. App developers can and do reach users on Android via app

stores other than Google Play, direct downloads, preinstallation by OEMs and MNOs, cloud

gaming, web apps, and non-Android platforms including iOS, PCs, and gaming consoles."[537]

Essentially Dr. Gentzkow's claim is that having access to alternative app distribution methods

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[534] Asker, John, "Diagnosing Foreclosure Due to Exclusive Dealing," The Journal of Industrial Economics, Vol. 64, No. 3, pp. 375-410, at 375.

[535] Gentzkow Report, ¶ 40.

[536] Gentzkow Report, ¶ 422 (citing to Koh (Google) Deposition).

[537] Gentzkow Report, ¶ 29.

suggests anticompetitive foreclosure has not occurred. However, Dr. Gentzkow's focus on channel access (or availability) is not grounded in antitrust principles. For example, Salop (2017), notes that foreclosure "generally describes exclusionary conduct that totally or partially 'forecloses' competitors from access either to critical inputs or customers, with the effect of causing them to raise their prices or reduce their output," and that crucially, foreclosure "does not require the exit of rivals, or even the permanent reduction in competitors' production capacity."[538] Therefore, it is not only access or availability that is important, but also whether rival app stores were disadvantaged in their ability to compete with the Google Play Store. how much Android users are using each channel must be analyzed in order to understand the degree of competition that remains.

237.   I cover Dr. Gentzkow's claims of access through many different channels in more detail below.

2.   Dr. Gentzkow Provides Limited Examples of Pre-Installation

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[538] Steven Salop, "The Raising Rivals' Cost Foreclosure Paradigm, Conditional Pricing Practices, and the Flawed Incremental Price-Cost Test," 81(2) ANTITRUST LAW JOURNAL 371, pp. 376-377 (2017)

[539] Gentzkow Report, ¶ 181.

[540] Gentzkow Report, ¶ 183 (emphasis in original).

[541] Gentzkow Report, Exhibit 14.

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████████████████████[542] Importantly, this evidence just shows whether a store is available or installed on an Android device. It does not show whether Android users are *using* these pre-installed app stores to download apps, nor does it show other important dimension of competition such as whether these app stores have a similar selection of apps (in terms of both quantity and quality).[543]

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████████████████████████[544] For example:

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Exhibit 12

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Sources:
1. GOOG-PLAY-007203253.
2. GOOG-PLAY-010801683.

242. ██████████████████████████████████
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[545] Gentzkow Report, ¶ 181.

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example, the CMA Consumer Survey found just 6% of Android users had downloaded apps

from the Amazon Appstore and only 1% used the store most often – compared with 92% and

90% for the Play Store respectively).[548] This evidence suggests that, despite the OEM or MNO

contracts, penetration was still a fraction of Google Play Store's penetration. Additionally, any

app store that is preinstalled competes with the OEM app store. Economics would suggest the

cost of preinstallation to the rival app store would be higher than what developers would

typically pay for preinstallation of apps because a rival app store would cannibalize the OEM's

own app store. Thus, the cost of pre-installation of rival app stores channel may face relatively

high costs.

        3.   *D*r. Gentzkow's Statistics on Sideloading are Misleading or Not Reliable

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[546] Gentzkow Report, footnote 205. ██████████████████████████████████
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██████████████████████████ 705-728, at 711-712.
[548] Rysman Opening Report, Exhibit 44

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████████████████████████████████ In addition, Samsung is disincentivized from

pre-loading any other Android app stores in order to protect its own share of the market for

Android app distribution. Thus, for a large proportion of Android devices (*i.e.*, Samsung

devices), pre-installation of a non-Play (and non-Galaxy App Store) is not a viable distribution

channel.[551] Also, his evidence of direct downloads of app stores ("3 percent for devices in the

United States, but reaches 12 percent in India, and 23 percent in Iran") also shows a limited

number of Android users directly download an alternative app store, let alone use that app store

to download apps (see my statistics on app store visits, Android app downloads, consumer

expenditure, and user engagement presented in my Opening Report).[552]

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[549] Gentzkow Report, ¶ 183.

[550] Gentzkow Report, ¶ 183.

[551]*See,* Rysman Rebuttal Report Backup Production; IDC, "IDC Quarterly Mobile Phone Tracker, 2021Q4 Historical Release," February 11, 2022.

[552] Gentzkow Report, footnote 211; Rysman Opening Report, ¶¶ 305-308.

[553] Gentzkow Report, ¶ 185 (emphasis in original).

[554] Gentzkow Report, ¶ 185.

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> ### 4.   Dr. Gentzkow's Developer Multi-homing Claim Ignores Constrains on Competition

247.   Dr. Gentzkow makes a similar error in seizing on Fortnite installation data, which I understand he revised in his Supplemental Report based on newly produced data from Epic.

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██████████████[561] When Fortnite launched on Android devices, it was initially not available on the Google Play Store. ███

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248.   Dr. Gentzkow also argues that "Android app developers can and do reach users via preinstallation of their apps by OEMs and MNOs" and cites various examples of preloaded apps.[562] As explained above at paragraph, these isolated examples do not prove Google has not foreclosed rivals as they have not had a meaningful impact on Google's dominance of the Android App Distribution Market. Given space constraints on the device and complaints from OEMs to Google about "bloatware," this alternative distribution channel would at best provide competition for a small number of apps. Therefore, Dr. Gentzkow fails to show these agreements have allowed "meaningful competition" in the Android App Distribution Market.[563]

F.   Dr. Gentzkow's Arguments Regarding Prices are Flawed or Irrelevant

249.   Dr. Gentzkow presents a series of analyses to demonstrate that Google Play's "service fee" (*i.e.*, pricing) structure is effective and prices by several measures have been decreasing. There are several flaws in these analyses and conclusions, which I explain below.

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[561] Gentzkow Supplemental Report, ¶ 6 & Ex. S.1.

[562] Gentzkow Report, ¶ 199.

[563] As stated in my Opening Report, "[b]y erecting roadblocks to each alternative method of Android App Distribution, Google prevents meaningful competition over the distribution of other Android app stores through the Google Play Store by foreclosing channels through which competitors could reach end-consumers, the Android users" (Rysman Opening Report, ¶ 14).

1.   The Relevant Standard to Evaluate Prices is Competition

250.   Dr. Gentzkow claims that the Google Play "service fee" (*i.e.*, price) is "effective,"
if it "allows the platform sponsor to earn an economic return on its investments and innovations
while aligning the incentives of platform participants to make decisions in a way that will create
value for the platform as a whole."[564]

251.   Dr. Gentzkow presents five factors that he claims indicate whether a service fee is
"effective" based on the economic literature (including my own work) and reasoning.[565] First,
the service fee structure "needs to be feasible to administer given the information available to the
platform sponsor."[566] Second, effective service fees "tend to be proportional to an app
developer's earnings from eligible transactions rather than a fixed amount that is the same for all
app developers."[567] Third, effective service fees "may be lower for transactions for which
marginal costs are large relative to revenue."[568] Fourth, it may be effective "to charge lower fees
as a share of revenue for apps that provide unusually large positive spillovers on other platform
participants."[569] And fifth, "an effective service fee should generally apply to transactions
regardless of whether they occur immediately at the time platform participants are matched to
each other or significantly later."[570] He then concludes that: "[t]he service fee structure Google
has established for Google Play is consistent with the principles just described and thus shares
many of the features we would expect to see in an effective, procompetitive structure that
maximizes the total value created for platform participants."[571]

252.   The literature Dr. Gentzkow cites in this section does not support the proposition
that the five factors will result in a procompetitive pricing structure. Instead, it primarily provides

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[564] Gentzkow Report, ¶ 137.
[565] Gentzkow Report, ¶¶ 144-153.
[566] Gentzkow Report, ¶ 145.
[567] Gentzkow Report, ¶ 146.
[568] Gentzkow Report, ¶ 148.
[569] Gentzkow Report, ¶ 151.
[570] Gentzkow Report, ¶ 152.
[571] Gentzkow Report, ¶ 154.

insights into the complexity and properties of pricing in two-sided platforms[572] and into the benefit from using revenue share contracts relative to non-sharing contracts in supply chains when demand is uncertain.[573] He cites to this literature in support of the importance of pricing strategies for two-sided platforms where insights from one-sided markets often do not apply,[574] to support the propositions that "effective service fees will tend to be *proportional* to…earnings from eligible transactions rather than a fixed amount"[575] and "may be lower for transactions for which marginal costs are large relative to revenue,"[576] and that an effective price structure charges "lower fees as a share of revenue for apps that provide unusually large positive spillovers."[577] None of these propositions discuss competition in either of the relevant markets, and the sections referenced in the literature do not discuss the effect of these pricing features on competition.

253.   Moreover, in asserting that prices are "effective," Dr. Gentzkow conflates "effective" with "competitive."[578] In fact, Dr. Gentzkow does not mention the term "procompetitive" in any of his explanations of the five factors as he presents them. It is only in

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[572] *See* Jean-Charles Rochet and Jean Tirole, "Platform Competition in Two-Sided Markets," *Journal of the European Economic Association*, Vol. 1, No. 4, 2003, pp. 990-1029; David S. Evans and Richard Schmalensee, "The Antitrust Analysis of Multisided Platform Businesses," *Oxford Handbook of International Antitrust Economics*, Vol. 1, 2014, pp. 404-448; Andrei Hagiu, "Two-Sided Platforms: Product Variety and Pricing Structures," *Journal of Economics & Management Strategy*, Vol. 18, No. 4, 2009, pp. 1011-1043; Thomas Eisenmann et al., "Strategies for Two-Sided Markets," *Harvard Business Review*, October 2006; and Marc Rysman, "The Economics of Two-Sided Markets," *Journal of Economic Perspectives*, Vol. 23, No. 3, 2009, pp. 125–143.

[573] *See* Nelly Bart *et al.*, "Revenue-Sharing Contracts in Supply Chains: A Comprehensive Literature Review," *International Journal of Production Research*, Vol. 59:21, No. 21, 2021, pp. 6633-6658; Yinliang Tan and Janice E. Carrillo, "Strategic Analysis of the Agency Model for Digital Goods," *Production and Operations Management,* Vol. 26, No. 4, 2017, pp. 724–741; Yinliang Tan et al., "The Agency Model for Digital Goods," *Decision Sciences,* Vol. 47, No. 4, 2016, pp. 628-660; Yunzeng Wang et al., "Channel Performance Under Consignment Contract with Revenue Sharing," *Management Science*, Vol. 50, No. 1, 2004, pp. 34-47.

[574] Gentzkow Report, ¶¶ 138-139.

[575] Gentzkow Report, ¶ 146.

[576] Gentzkow Report, ¶ 148.

[577] Gentzkow Report, ¶ 151.

[578] To the extent that, by "effective," Dr. Gentzkow means "efficient," a monopolist who can perfectly price discriminate can achieve an efficient market outcome; the market equilibrium for a perfectly price discriminating monopolist results in the same output level as a competitive equilibrium and therefore statistically efficient. *See, e.g.,* Carlton and Perloff, *Modern Industrial Organization*, Third Edition. pp. 282-283.

summarizing his discussion of these factors that he refers to these factors as showing that Google's service fee is "consistent with an *effective, procompetitive* structure."[579] Just because the price structure is "effective" in the way that Dr. Gentzkow uses this term (such as fees being proportional to developer earnings or fees being lower for transactions with high marginal costs relative to revenue) does not mean that Google operates in a competitive market or lacks market power, nor that these pricing choices enhance competition. For example, a monopolist and a firm operating in a competitive market can both impose a service fee structure that is "feasible to administer given the information available." Thus, this factor sheds no light on whether a market is competitive. In addition, Dr. Gentzkow has not shown that his "effective" price is not consistent with anticompetitive conduct such as prices that result in foreclosure.

254.   Moreover, any firm should desire "effective" prices whether it has monopoly power or not. The relevant question is whether price *levels* have been set through competition. But Dr. Gentzkow's discussion conflates pricing structure with price level. For example, Dr. Gentzkow states that "app developers make many decisions that will be impacted by the structure of the service fee …[including choosing] whether to develop for Android at all…," "what channel(s) to distribute through within Android," "how much to invest in developing and supporting their app and enhancing its quality," [and] "set[ting] the prices that users pay for downloads and in-app purchases."[580] For decisions such as determining how much to invest, app developers need to know the magnitude of the price, not just the form that the price will take.

255.   Therefore, Dr. Gentzkow's opinions about the "effectiveness" of Google's price structure are simply beside the point.

        2.   *Dr. Gentzkow Overlooks that Google Already Negotiates with Developers*

256.   Under the first factor Dr. Gentzkow presents for an effective service fee, he also states that "[a]ny structure that required the platform to individually tailor or negotiate a different

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[579] Gentzkow Report, ¶ 154, 154a, 154b, 154c, 154d, 154e, and 154f.
[580] Gentzkow Report, ¶ 140.

service fee for each of the millions of apps on its platform would be costly to administer."[581] However, subjecting Google Play to competition would not require individual negotiations for every app, as Google could simply offer a lower, competitive commission rate to all developers.

257. In any event, the concern Dr. Gentzkow raises is moot. Google already negotiates and tailors its service fee in limited instances, for example, when it has faced pressure from important developers.[582]

258. Moreover, as noted in my Opening Report, it is widely accepted in economics that price discrimination – such as Google charging certain developers a higher commission rate than other developers – can occur only if a firm has market power.[583]

3. Dr. Gentzkow's Claims about Mobile Device Prices are a Red Herring

259. Dr. Gentzkow claims that decreasing Android mobile device prices indicate vigorous competition.[584] However, decreasing prices for Android *mobile devices* do not have any bearing on an analysis of competition in the Android *App Distribution Market*. There is no evidence that prices set in the Google Play Store have any effect on pricing for Android mobile devices. As I noted in my Opening Report, when purchasing smartphones, consumers do not consider all the apps and in-app content they will purchase during the life of the phone; thus, consumers' inability to lifecycle price demonstrates Android mobile device prices are not the relevant metric to evaluate Google's conduct in Android App Distribution. Even if Play Store price affects pricing for Android mobile devices, the job of economists is to understand what the competitive effects are in the well-defined relevant markets. I do not define a smart mobile device market. Even if I did, the conduct I have reviewed is directed at the two markets I

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[581] Gentzkow Report, ¶ 145.

[582] Rysman Opening Report, ¶¶ 107, 468 and Exhibit 16.

[583] Rysman Opening Report, ¶ 286. *See*, Varian, Hal R, "Price discrimination," in *Handbook of Industrial Organization*, Vol 1, Eds. R. Schmalensee and R.D. Willig, Elsevier Science Publishers B.V., 1989, pp. 597-654, available at https://doi.org/10.1016/S1573-448X(89)01013-7.

[584] Gentzkow Report, ¶¶ 28, 161 ("Standard economic indicia for the Android ecosystem are consistent with vigorous competition," including "quantities of both Android devices and Android app transactions have increased dramatically, while device prices have fallen dramatically.").

propose; Dr. Gentzkow's claimed procompetitive effects are realized, if at all, outside of these markets. Indeed, no economist in this case, including Drs. Gentzkow and Tucker, has defined a relevant antitrust market of smart mobile devices. Thus, mobile device prices are not the correct prices to evaluate; rather, prices (or fees) for distributing apps on Android and in-app purchasing are the appropriate metric to consider in determining whether Google's challenged conduct was anticompetitive.

4.   Dr. Gentzkow's Average Commission Rate is Incorrect and Misleading

260.   Dr. Gentzkow claims that recent declines in Google's average commission are "consistent with an innovative market that produces large social surplus, and the opposite of what economists would typically expect when a dominant firm had foreclosed competition in order to enrich itself at the expense of consumers."[585] He contends "that the average service fee rate paid by the minority of U.S. app developers that did pay service fees remained roughly constant at approximately 30 percent during Android's early history and has subsequently fallen as Google introduced lower-fee tiers for subscriptions and smaller app developers."[586] ███

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█████████. There are several issues with Dr. Gentzkow's analysis.

261.   First, Dr. Gentzkow presents the average commission as a simple average and does not account for the amount of consumer spend at those commission rates. However, a proper calculation of what has happened to Google's commission would weight by the consumer spend to which the commission applies. |Only then can one understand the overall impact of the change in commission on developers and consumers (rather than over-emphasizing a commission rate reduction that applies to very few transactions).

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[585] Gentzkow Report, ¶¶ 155, 162, and Exhibit 4.
[586] Gentzkow Report, ¶ 162.

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██[587] However, there is no

reason to limit commission rates to those paid by *U.S.* app developers in calculating Google's

average commission to developers. As I explained in my Opening Report, app developers have

an incentive to reach all Android users and are not limited in distributing their apps to Android

users in their own geographic location.[588] Thus, even if the geographic market is limited to

Android smart mobile device *users* in the U.S., as Google's consultant Dr. Tucker claims, app

developers outside the U.S. have an incentive to distribute apps to these U.S. consumers and,

thus, Google's average commission should include non-U.S. developers that distribute to U.S.

consumers.

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██ *See* Rysman
Rebuttal Report Workpapers.

[588] Rysman Opening Report, ¶ 232.

[589] Rysman Opening Report, ¶ 286.

[590] Leonard Report, ¶ 178.

Exhibit 13
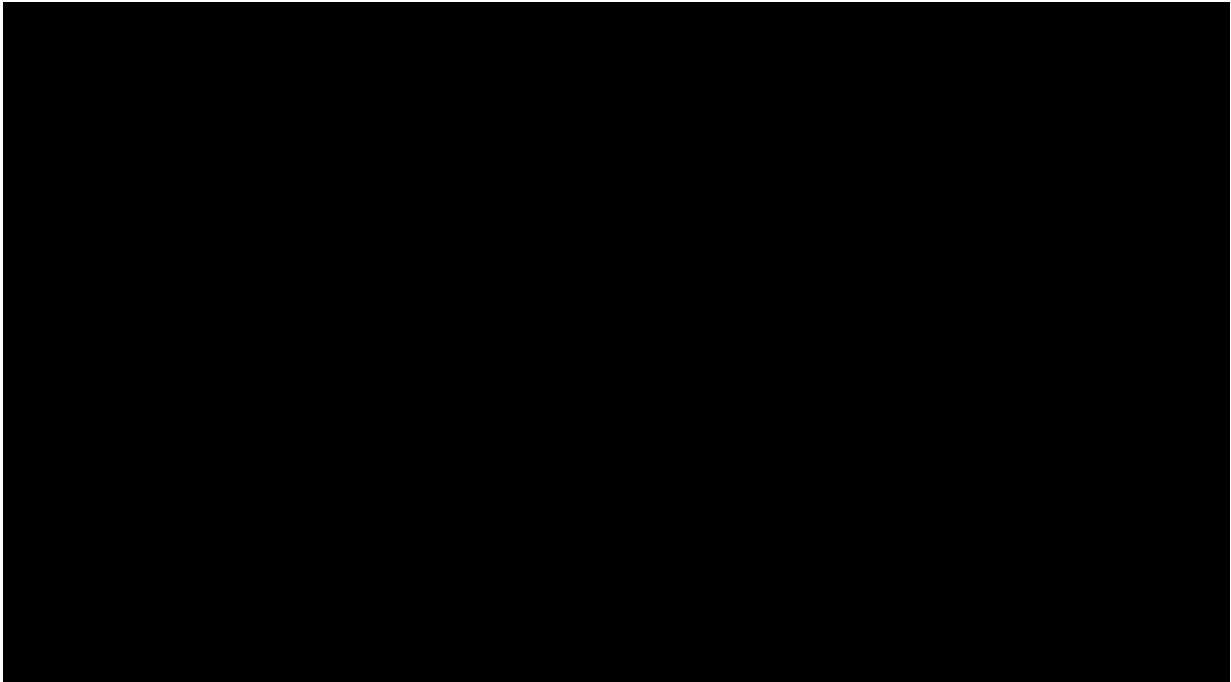
Notes:

1. App developer quarterly service fee rates that are zero, negative or greater than 100% are excluded from the calculation of the average service fee rate.

2. Simple average service fee rates are computed as the arithmetic average of app developer specific service fee rates in a given quarter. Data used is U.S. developers and their revenue from users worldwide.

3. Weighted average service fee rates are computed as a weighted average of app developer specific service fee rates, using the transaction dollars to which that service fee rate was applied as weights. Data used is worldwide developers and their revenue from users in the U.S.

Sources: GOOG-PLAY-005535886; GOOG-PLAY-005535885; GOOG-PLAY-010801689; GOOG-PLAY-010801688.

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[591] Rysman Opening Report, § IV.B.5 and Exhibit 15. ¶¶ 289-290 and Exhibit 37.

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████████████████████████████████████[593] There are several issues with his Exhibit 4.

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██.[594] ████████████████████

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████████████████████████████████████[595] █████████████████████████████

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267.   ██

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[592] Rysman Opening Report, § IV.B.5 and Exhibit 15. ¶¶ 289-290 and Exhibit 37.

[593] Gentzkow Report, ¶ 162 and Exhibit 4.

[594] Letter from Brian C. Rocca to Melissa R. Coolidge, October 8, 2021, p. 2 (stating "[i]t is possible there are apps identified in transactions in GOOG-PLAY-005535885 through GOOG-PLAY-005535890 that have been removed from Play. For example, if purchases were made related to an app in 2020, but that app has since been removed, it would not have been listed in GOOG-PLAY-001507601 since that pull was as of June 2021." It also confirms that "for apps found in GOOG-PLAY-005535885 through GOOG-PLAY-005535890, but not found in GOOG-PLAY-001507601…[a]pp removal from Play Console is the only reason we are aware of.").

[595] *See* Rysman Rebuttal Report Workpapers.

[596] It is also the case that Google's app catalog data contain apps that are not included in Google's monthly app revenue data, further clouding the impact on his analysis.

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Exhibit 14

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Notes:

1. Shares are calculated by dividing the number of apps published in a given quarter at a given commission by all apps published in that quarter that pay service fees.

2. Service fees over 100% are excluded.

Sources: GOOG-PLAY-005535886; GOOG-PLAY-005535885; GOOG-PLAY-010801689; GOOG-PLAY-010801688; GOOG-PLAY-001507601; GOOG-PLAY-001507602.

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███████████████████████████████████.[597] I understand that unpublished and suspended apps

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[597] *See* Rysman Rebuttal Report Workpapers.

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may be unable to engage in transactions.[598] Therefore, the commission rates that apply to them are not nearly as probative as Dr. Gentzkow claims.

269.   The share of new apps to which service fees apply is the ratio of the number of new apps to which service fees apply divided by the total of number of new apps. ███████████

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██████████████████████████████████ However, if the number of new apps to which service fees do not apply is high, that could be indicative of apps choosing unpaid monetization strategies in response to Google's high rate as certain developers have done. Moreover, if the number of new apps to which service fees apply is increasing, then Google is increasing revenue, which is the opposite of how he presents his results. ████████████

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[598] *See* Play Console Help, Google, "My App Has Been Removed from Google Play," https://support.google.com/googleplay/android-developer/answer/2477981?hl=en#zippy=%2Csuspensions (explaining that suspended apps are removed from Google Play and that once an app is suspended it "forfeit[s] the users, statistics, and ratings of the removed application" and that "If your app has been removed or suspended from Google Play, its users may receive a push notification from Google Play Protect informing them of this change and giving them the option to remove the app from their device. Users will also have the option to keep the app."); Play Console Help, Google, "Update or Unpublish Your App," https://support.google.com/googleplay/android-developer/answer/9859350?hl=en ("When you unpublish an app, existing users can still use your app and receive app updates, but new users won't find and download it on Google Play.").

Exhibit 15
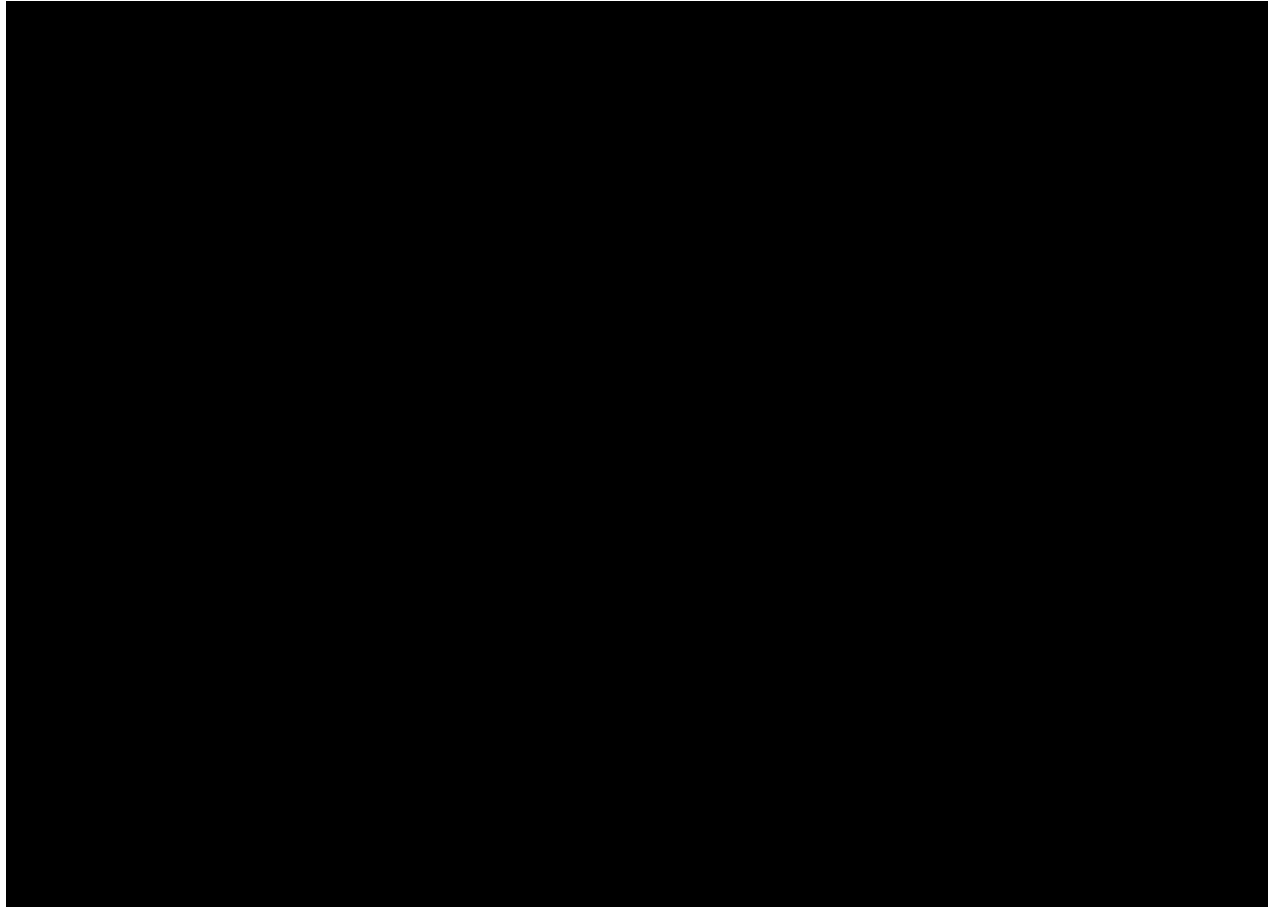
Sources: GOOG-PLAY-001507601; GOOG-PLAY-001507602

270.   Finally, Dr. Gentzkow ignores what prices would have been absent Google's conduct. Even assuming for the sake of argument that his presentation of the changes in Google's commission rate is accurate, the proper question is what would have happened to Google's commission rate in a world absent Google's challenged conduct. As I demonstrated in my Opening Report, in the limited instances in which Google faced pressure from certain important developers and thus some very limited competition, Google profitably charged a much lower commission rate.[599] Thus, in the but-for world in which all apps benefit from competition in both markets, commission rates for all apps would similarly decrease.

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[599] Rysman Opening Report, § VIII.A.4.

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5.   *Dr. Gentzkow's Comparison of Commission Rates of Alternative Mobile App Stores is Misleading*

271.   Dr. Gentzkow contends that the "rates publicly reported or presented to app developers" by alternative mobile app stores should be compared with Google's published rates "for consistency of comparison."[600] Exhibit 10 of his report presents such rates for a selection of mobile app stores. However, what is relevant are the rates developers actually pay, and, thus, the net commission rate should be the point of comparison. Comparing published commission rates across app stores is akin to comparing list prices when discounted prices are what customers actually pay, particularly when customers can negotiate rates/discounts. Dr. Gentzkow recognizes this point in that his entry for the Samsung Galaxy Store in Exhibit 10, which states "30% (*or otherwise agreed upon*)" pointing out the example of "Epic negotiat[ing] a 12 percent service fee for the Galaxy Store."[601] Nonetheless, he ignores this fact in concluding the published rates should be compared "for consistency."[602] ████████████████████████

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G.   Dr. Gentzkow's Procompetitive Justifications are Flawed

272.   Dr. Gentzkow claims that Google's challenged conduct is needed to "address a set of collective action problems that arise on smart device platforms because many participants individually have incentives to behave in ways that do not maximize the value of the platform for all participants."[603] He lists these four problems as "(i) coordinating early adoption and

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[600] Gentzkow Report, ¶¶ 170-171 and Exhibit 10.

[601] Gentzkow Report, Exhibit 10 (emphasis added).

[602] Gentzkow Report, ¶ 171.

[603] Gentzkow Report, ¶ 26.

investment, (ii) avoiding fragmentation, (iii) safeguarding security, and (iv) strengthening the Android brand by delivering a clean, consistent, and high-quality 'out-of-the-box' experience for users."[604] The first point is that, similar to his five-factor test created to demonstrate Google's commission structure is "effective," Dr. Gentzkow appears to create these factors to fit Google's business, as it is not grounded in economic analysis. Nonetheless, I consider Dr. Gentzkow's evidence under each of these four factors below.

1. Dr. Gentzkow's Claim that Google's Challenged Conduct Resolves Fragmentation Fails to Recognize Important Evidence

273. Dr. Gentzkow opines that the challenged Google conduct is justified by a procompetitive benefit of overcoming fragmentation.[605] To the extent that fragmentation is associated with competition, it is possible for the benefits of competition to outweigh the benefits of coordination on a single proprietary network.[606] Furthermore, as I discuss below, other platforms, too, could have addressed any efficiency costs of fragmentation but for Google's conduct that prevented them from competing effectively against the Google Play Store.

a) OS Fragmentation

274. Dr. Gentzkow claims that Google's RSAs and ACC/AFA are procompetitive because they overcome "device fragmentation," which he defines as a "situation in which the devices in the ecosystem are incompatible or only partly compatible with each other—i.e., they do not share a common baseline set of core capabilities and features that app developers rely on."[607] My report is about the app distribution market. Whether OS fragmentation is beneficial for the market or not, and whether Google's behavior towards OS fragmentation is anticompetitive or not, is outside the bounds of my opinion.

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[604] Gentzkow Report, ¶ 26.

[605] Gentzkow Report, ¶¶ 26, 104, 105 and §§ VII.B, IX.B; see also Chatterjee §§ III, IV.C, V.C-V.D.

[606] See Rysman (2004).

[607] Gentzkow Report, ¶ 104.

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███████████[614] such as PalmOS devices.[615] ████████████████████████████████

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[608] Vogelsang Deposition, pp. 10-11 █████████████████████████████
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[609] Vogelsang Deposition, p. 32 █████████████████████████████████).

[610] Vogelsang Deposition, p. 14 ████████████████████████████████
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[611] Vogelsang Deposition, pp. 13-14 ███████████████████████████
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[612] Vogelsang Deposition, p. 32 ██████████████████████████████
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[613] Vogelsang Deposition, 16 ████████████████████████████████
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[614] Vogelsang Deposition, pp. 48-49 ██████████████████████████
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[615] Stephen Lawson, Stephen, NetworkWorld, "Qualcomm Extends BrewREW to Download PalmOS Apps," *NetworkWorld*, (March 18, 2003), available at https://www.networkworld.com/article/2340802/qualcomm-extends-brew-to-download-palmos-apps.html.

[616] ██████████████████████ June 2009, QCUTAH05227_0000001-094, at -007.

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Qualcomm marketed Plaza Retail as platform-neutral or "platform agnostic,"[617] meaning that it would support apps on a variety of mobile OSs.

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██████████████████████████████████████[621] In addition, Google's RSAs with MNOs disincentivized them from investing in their own first-party app stores. █████████████████

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[REDACTED]

        b)   App Store Fragmentation

277.   Dr. Gentzkow refers to the second form of fragmentation as *app store fragmentation*, which "occurs when no app store(s) contain a comprehensive set of apps and many app stores are accessible only to certain groups of users. Just like device fragmentation, this creates inefficiency because it prevents users from efficiently transacting with the full range of app developers and vice versa."[622] Importantly, Dr. Gentzkow recognizes that "fragmentation does not increase just because more app stores enter, existing app stores become more successful, and/or app distribution becomes more competitive."[623] [REDACTED]

[REDACTED]

[REDACTED][624]

278.   [REDACTED]

[REDACTED]

[REDACTED][625] [REDACTED]

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[622] Gentzkow Report, ¶ 105.

[623] Gentzkow Report, ¶ 105.

[624] *See*, Rysman Opening Report, ¶ 521 (citing Christopoulos Deposition,. p. 58 [REDACTED]

[REDACTED]

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[REDACTED]

[REDACTED] 92:5-16 [REDACTED]

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[REDACTED]

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[625] Rysman Opening Report, ¶ 521.

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Exhibit 16

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Exhibit 17

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280. [REDACTED]

[REDACTED] [629] [REDACTED]

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[629] Christopolous Deposition, p. 110; *see also id.* at p. 161 ([REDACTED]); *id.* at pp. 105-106 ([REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]);
id. at p. 97 ([REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED].

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        c)   Dr. Gentzkow Ignores Evidence from China

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282.   Dr. Gentzkow ignores important idiosyncrasies about China in drawing this comparison. As one app localization guide notes: "Get prepared to enter a new market, where everything is different – from pricing strategies to business models and buying habits. Knowing if you have a chance to sell in a place where people have different interests from your current customers is essential, especially if you're looking for profits and global success."[633] This suggests that Dr. Gentzkow's argument that because prices are sometimes higher in China, competition should be restrained everywhere is unsupported and facile.

283.   Dr. Gentzkow also ignores important facts about how the fragmented nature of the Chinese app store market fosters innovation, including evidence from a Google document he

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[630] Christopolous ████████ Deposition, p. 105 █████████████████████
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[631] Gentzkow Report, ¶ 642.

[632] Gentzkow Report, ¶ 643.

[633] Phrase, "Your Guide to App Localization for the Chinese Market (Part 1)," available at https://phrase.com/blog/posts/beginners-guide-app-localization-chinese-market/.

relies on for his claims regarding China's app fragmentation. For example, the flexible nature of the app economy has allowed mini-programs to develop, which are "tiny app versions" that are "used within WeChat and other services" to "help users interact with stores and games," which if developers can adapt to, they "will enjoy fewer restrictions and succeed."[634] ██████████████

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███████████████████████████"[635] In addition, a report by McKinsey & Company about the future of digital innovation in China notes China has a "digital ecosystem that fosters innovation," which has spawned, for example, "so-called super apps" with "advanced digital payments services" that boast "massive user bases and high-frequency engagement, enabling their developers to divert huge traffic into a portfolio of offerings, hosted in-house or via partners."[636]

2. Dr. Gentzkow's Security Rationale is Flawed

284.   ██

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██████[637] This is yet another argument that competition itself is bad, not an explanation of how Google's behavior increases competition (*i.e.*, is pro-competitive) in one of the relevant antitrust

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[634] Ou, Tiffany, "A Breakdown of China's Android Market," Business of Apps, July 6, 2020, https://www.businessofapps.com/insights/a-breakdown-of-chinas-android-market/.

[635] Google, "Android in China: A Parallel Universe," GOOG-PLAY-000272539.R-699.R, at 675.R.

[636] Bu, Lambert, et al., "The Future of Digital Innovation in China," McKinsey Digital, October 2021, available at https://www.mckinsey.com/featured-insights/china/the-future-of-digital-innovation-in-china-megatrends-shaping-one-of-the-worlds-fastest-evolving-digital-ecosystems.

[637] Gentzkow Report, ¶ 470.

markets that I have defined. ████████████████████████████████

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████████[640] Moreover, Google Play Protect has a built-in security system that protects a user's
device; according to Google's guidance, "[i]f Play Protect detects a PHA, it displays a warning"
and, "[f]or certain malicious apps, Play Protect automatically disables or removes the app."[641] █

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Dr. Gentzkow's claim that Google's strategy that lets users "with varying preferences and levels
of sophistication balance security risks in different ways"[643] ignores that Google's restrictions

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[638] Qian Report, Figure 6. *See also* PX2666, GOOG-PLAY-000094746, at -749, Android 10 Consumer Release
Comms. Doc (Sept. 2019) ████████████████████████████████████

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[639] Rysman Opening Report, ¶ 436, citing to Google, ████████████ GOOG-PLAY-000415076-078, at 076-
077.

[640] Deposition of David Kleidermacher, Vice President of Engineering at Google, February 3-4, 2022, p. 131.

[641] *See*, Google Play Protect, "Potentially Harmful Applications (PHAs)," available at:
https://developers.google.com/android/play-protect/potentially-harmful-applications.

[642] Rysman Opening Report, ¶ 436.

[643] Gentzkow Report, ¶ 470.

actually limit users with varying preferences and levels of sophistications from making choices to balance security risks in different ways.

286.   However, alternative app stores not pre-installed are still disadvantaged. ████

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288.   Finally, I would also note that even if, for the sake of argument, I accept Dr. Gentzkow's claims that the challenged conduct related to security has not foreclosed access via direct downloading, then Google's restrictive behavior might not be anticompetitive with regard

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[644] ████████████████████████████████████_00005705-728, at 712.
[645] Gentzkow Report, ¶ 483.
[646] Gentzkow Report, ¶ 485.
[647] Rysman Opening Report, ¶¶ 151-152.

to sideloading, in which case I should not include direct downloading / sideloading in the relevant market. This would only have the effect of *increasing* Google Play Store's market share in the Android App Distribution Market in any event and would be a less conservative assumption.

3. Dr. Gentzkow Does Not Show that Google Play Revenue Led to Investment in the Android Ecosystem

289.   Dr. Gentzkow claims that "[i]n a but-for world where the ability to earn revenue through service fees was reduced or eliminated, Google's incentives to support the ecosystem would be weakened and users and app developers would likely suffer as a result. Google would have less incentive to take costly steps to expand the Android ecosystem and compete effectively with iOS."[648] However, Dr. Gentzkow never shows that revenue from the Google Play Store service fee led to investment in the rest of the ecosystem or what the counterfactual effect would be. In fact, Google earns revenue from Android in a variety of ways, such as the Google Play Store, search advertising when consumers use Chrome (the default browser), display ads, and through YouTube. Thus, even without Google Play Store revenue, Google would still be incentivized to invest in the Android ecosystem in order to maintain and grow these revenue sources.

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[648] Gentzkow Report, ¶ 637.

Exhibit 18
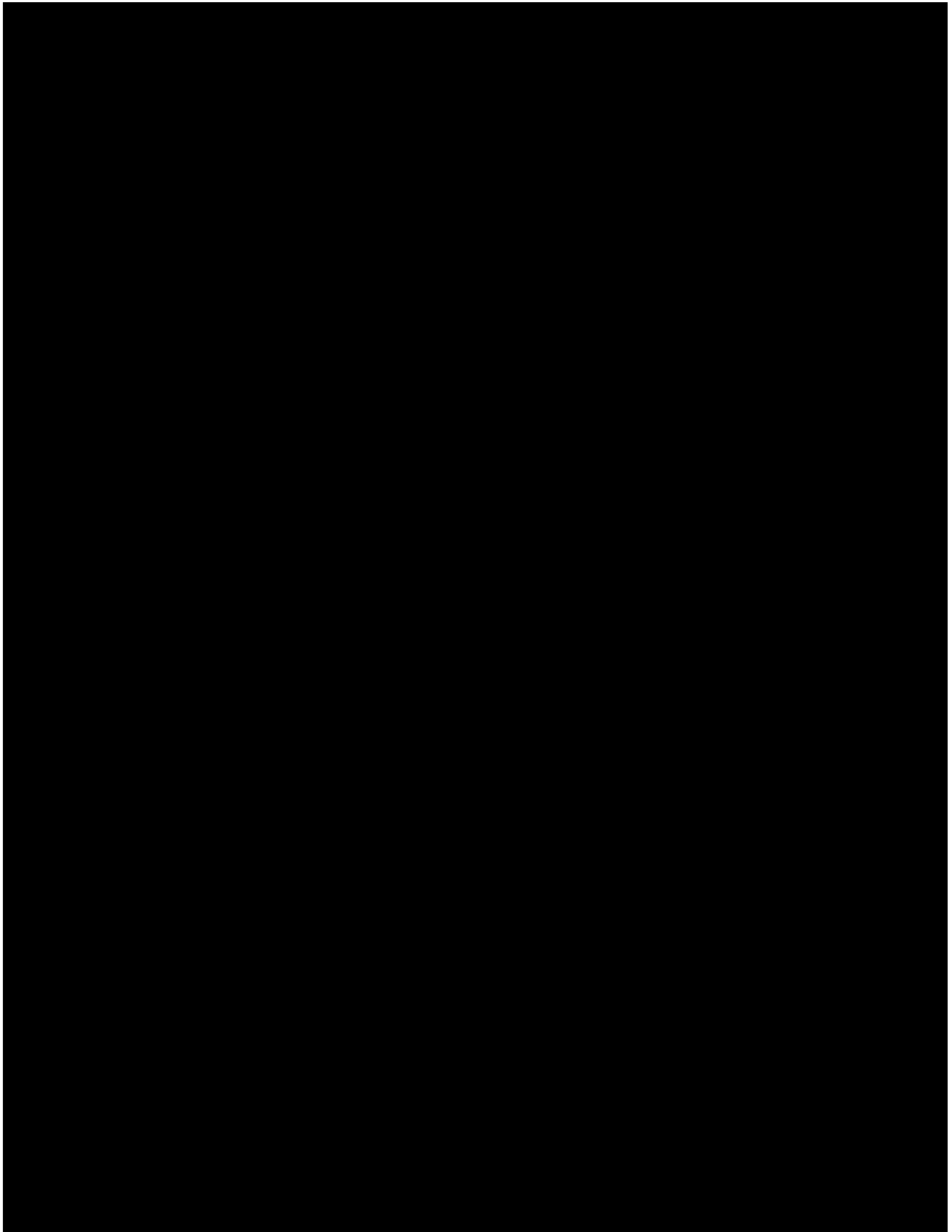
291.   Investment is inherently forward-looking so, to the extent that Google could predict the falling revenue share of the Google Play Store, it would have become less important in driving investment well before the lower shares arrived. Additionally, the Android revenue does not include revenue from other sources that presumably benefit from a strong Android product, such as sales of the Google Pixel phone and Watch (not to mention any data harvesting that Google is able to exploit through sales of Android products). Thus, it is entirely plausible that Google would continue to invest in the Android operating system even with a lower level of Google Play Store revenue. Dr. Gentzkow fails to establish that Google Play Store revenue led to investment by Google in Android. ████████████████████████████████
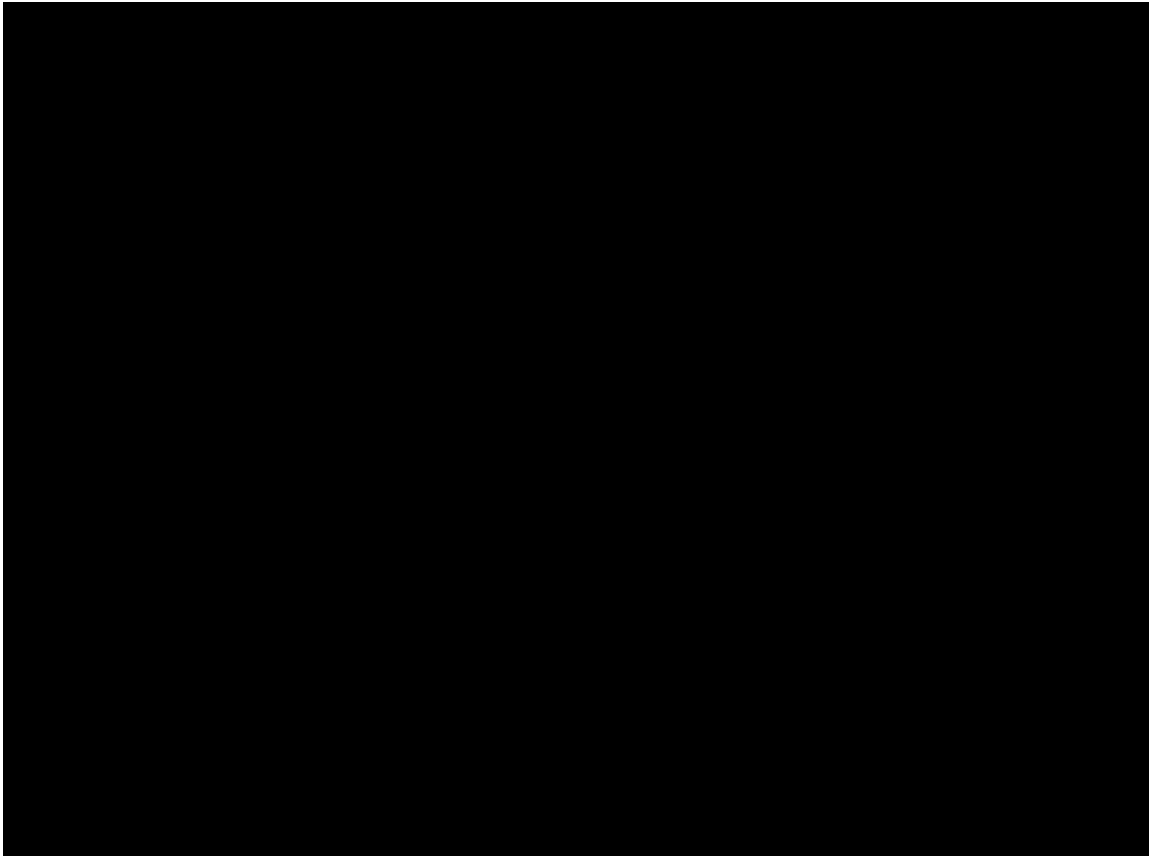
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Exhibit 20

Notes:

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4. Ads on Play revenue was also included in the estimate for Android revenue, since the costs for Ads on Play are included in the estimate of Android expenses.

5. The revenue from China is excluded from the calculation of Android revenue.

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Exhibit 21
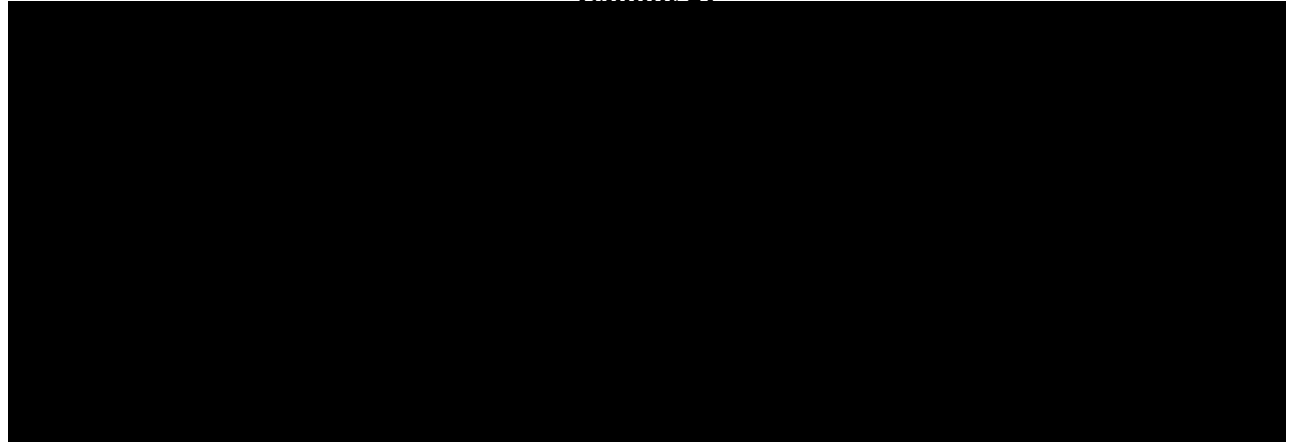
Notes:

1. Alphabet Inc. and Google Inc. make changes to the reporting of their revenues over time. Where available, the revenues listed here reflect revenues reported for the "Google segment" of Alphabet Inc.'s total revenues as a conservative estimate of Google's revenues. Some revenue streams that may come from Google, such as "Google Cloud," are excluded from this segment in 2020 and 2021.

2. Worldwide Play Revenue includes China, in order to be more directly applicable to the total revenue from Google's financial statements, which include China.

Sources:

1. Alphabet Inc., "10-K," February 11, 2016, available at
   https://www.sec.gov/Archives/edgar/data/1288776/000165204416000012/goog10-k2015.htm.

2. Alphabet Inc., "10-K," February 3, 2017, available at
   https://www.sec.gov/Archives/edgar/data/1652044/000165204417000008/goog10-kq42016.htm.

3. Alphabet Inc., "10-K," February 6, 2018, available at
   https://www.sec.gov/Archives/edgar/data/1652044/000165204418000007/goog10-kq42017.htm.

4. Alphabet Inc., "10-K," February 5, 2019, available at
   https://www.sec.gov/Archives/edgar/data/1652044/000165204419000004/goog10-kq42018.htm.

5. Alphabet Inc., "10-K," February 4, 2020, available at
   https://www.sec.gov/Archives/edgar/data/1652044/000165204420000008/goog10-k2019.htm.

6. Alphabet Inc., "10-K," February 3, 2021, available at
   https://www.sec.gov/Archives/edgar/data/1652044/000165204421000010/goog-20201231.htm.

7. Alphabet Inc., "10-K," February 2, 2022, available at
   https://www.sec.gov/Archives/edgar/data/1652044/000165204422000019/goog-20211231.htm.

8. *See* Exhibit 19 sources.

4.   *Dr. Gentzkow does not Show that Foreclosure Provided a Better 'Out-of-the-Box' Experience*

293.   Dr. Gentzkow's fourth challenge is that "Google must use contracts to align the incentives of these partners to deliver the kind of out-of-the-box experience that can compete successfully with iOS and strengthen Android's brand," where an "out-of-the-box experience

requires that the device includes core apps that users expect including a safe, easy, and reliable way to get new apps."[649] He makes several unsupported assertions such as "OEM or MNO might benefit from omitting key apps, installing less relevant or lower-quality apps or app stores, or placing apps in a less user-friendly position," or that "[t]he OEM or MNO might have incentives to do so even if it worsens the user's experience—for example, because the OEM or MNO earns revenues from installation or use of these other apps or app stores."[650]

294.   However, Dr. Gentzkow does not explain why Samsung's (or other OEMs') incentives are not aligned to deliver a high-quality 'out-of-the-box' experience for their customers. Without their own operating systems, Samsung and other Android smart mobile device OEMs rely heavily on Android and the user experience their consumers receive when using their devices. Absent Google's conduct, Samsung and other device makers still have a strong incentive to give users what they want and expect, including a high-quality "out-of-the-box" experience.

295.   Furthermore, if OEMs have a revenue incentive that could lead them to make app choices that lessen the consumer experience, then Google has a revenue incentive to promote its own app store to the detriment of consumer benefits. Because competitive markets tend to dampen the ability of firms to make decisions that hurt consumers and because OEMs exist in a less concentrated market than Google's Android OS, it follows that the likelihood of Google taking such actions is higher. Additionally, Dr. Gentzkow does not show or even claim that consumers prefer having fewer app stores to more. If consumers want a smartphone with a single app store, they have a competitive option: the Google Pixel series of smartphones.[651] However,

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[649] Gentzkow Report, ¶ 130.

[650] Gentzkow Report, ¶ 130.

[651] Goodwin, Richard, "Which Android Phone Has the Least Bloatware? Let's Find Out…," December 16, 2020, available at https://www.knowyourmobile.com/user-guides/which-android-phone-has-the-least-bloatware-lets-find-out/ ("Each Android manufacturer has its own custom Android skin, a UX that sits on top of the Android software

the Google Pixel has a substantially smaller market share than Samsung, or other brands of Android smart mobile devices with more than one app store preinstalled. During the period 2016-2021, Google's share of Android smartphone device sales worldwide (excluding China) was less than 1%, as depicted in Exhibit 22 below; by contrast, Samsung's share was 32% to 36% during the same period.[652]

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and, in most cases, adds in features and abilities unique to that brand… Google's Android partners have gotten pretty good at creating good-looking, highly useful custom skins… When it comes to Android phones with no bloatware, you have a select few options. If you want a true Android experience, one with ZERO bloatware and Android running as Google intended, get a Pixel phone. … If you want stock Android, meaning Android as it runs on Google's Pixel phones, but you don't want to buy a Pixel phone, the next best option would be one of Nokia's Android phones.") I interpret this to mean that Pixel phones offer the "clean, consistent, and high-quality 'out-of-the-box' experience" in the sense that Dr. Gentzkow implies.

[652] Similarly, Google's share of Android smartphone device sales in the United States during the period 2016-2021 peaked at 6% in 2019 while Samsung's share in the U.S. during the same period ranged from 39% to 49%. See Rysman Rebuttal Report Workpapers.

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Exhibit 22
Google Smartphones have Minimal Share of Android Smart Mobile Device Sales,
2016-2021
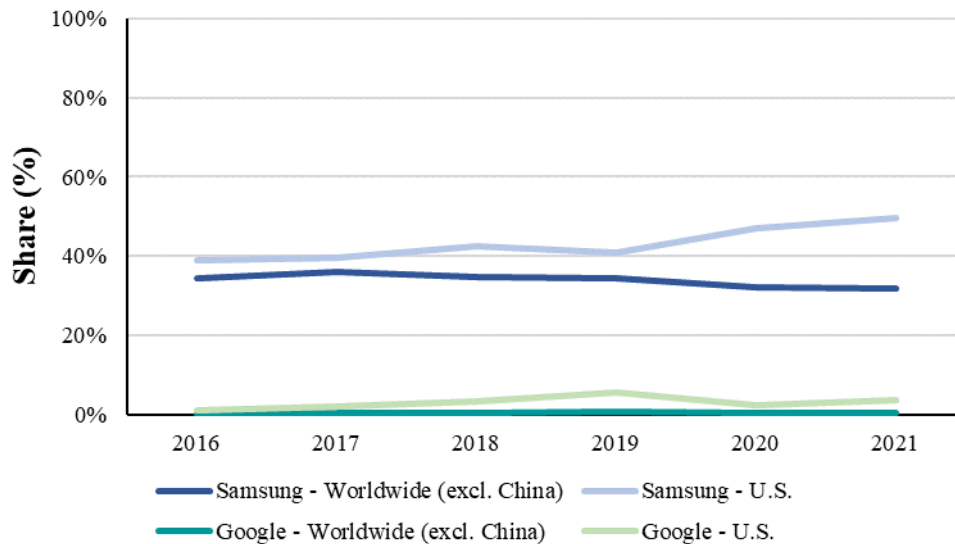
Note: Shares are calculated on the basis of Android smartphone units sold.

Source: Appendix D.

296.   While there may be multiple explanations for why Google has a lower market share than Samsung (or others), it is worth noting that the Pixel line of phones does very well on review websites. Wirecutter.com named the Pixel 7 it's top pick for Android phones in November 2022[653] and CNET gave the Pixel 6 an Editor's Choice Award for 2021.[654] Earlier generations of Google's Pixel phone also reviewed well.[655] These review articles do not mention the lack of OEM software as a positive (or negative) feature of the Google Pixel phones, suggesting that the relative benefit of Google's 'out-of-the-box' experience is of limited value. To the extent that Dr. Gentzkow is using Google's need to control OEM placement of

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[653] Whitwam, Ryan, "The 5 Best Android Phones," *The New York Times*, November 16, 2022, available at https://www.nytimes.com/wirecutter/reviews/best-android-phone/.

[654] Holland, Patrick, "Google Pixel 6 review: This phone is everything I wanted," *CNET*, November 20, 2021, available at https://www.cnet.com/tech/mobile/google-pixel-6-review/.

[655] La, Lynn, "Google Pixel review: Pure Android at its absolute best," *CNET*, October 18, 2016, available at https://www.cnet.com/reviews/google-pixel-review/ ("The Google Pixel remains our favorite phone, bar none -- unless you're looking for a bigger screen, in which case we'd recommend its big brother, the Pixel XL.").

OEM app stores as an explanation for otherwise anticompetitive behavior, the evidence I present here suggests it is unjustified.

H.   Dr. Gentzkow's Critiques Related to Android In-App Billing Services are Flawed

1.   Dr. Gentzkow's Claim that I Misinterpret Google' Service Fee is Incorrect

297.   Dr. Gentzkow claims "Plaintiffs' experts incorrectly interpret Google's service fee as a price Google charges for the use of the billing system alone."[656] However, Dr. Gentzkow's characterization is incorrect. As I explained in my Opening Report, in-app billing services, including Google Play Billing, are a bundle of complementary services, which includes receiving payment and authorizing the unlocking of the purchased in-app content through tokenization and may also include invoicing, payment history, refund processing, and subscription management.[657] I demonstrated that this bundle of services, which includes payment processing as one element, is a separate product from Android app distribution, for which developers have separate demand, and developers have alternatives to Google Play Billing, including providing the bundles of services themselves.[658]

298.   Dr. Gentzkow further claims that I incorrectly "directly compare[] Google's historic 30 percent service fee to the fees charged by third-party payment processors such as PayPal, Stripe, Braintree, and Adyen."[659] While I point out the transaction fees charged by various alternative billing service providers, which often charge a two-part commission with a percentage fee in the range of 2% to 3% and a fixed dollar amount per transaction of $0.12 to $0.49 as a point of comparison,[660] I did not use these rates as a but-for competitive commission rate. Instead, I used the 15% commission rate Google offered certain developers as the but-for competitive commission rate that would apply to all developers and launch sooner than it did in

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[656] Gentzkow Report, ¶ 544.

[657] Rysman Opening Report, ¶ 238.

[658] Rysman Opening Report, § V.D.2.

[659] Gentzkow Report, ¶ 544.

[660] Rysman Opening Report, ¶ 55 and Exhibit 8.

the actual world. Dr. Gentzkow ignores the fact that my but-for commission rate is not based on the fees charged by these various third-party payment processors, but instead on Google's own rates.[661]

2. Dr. Gentzkow's Characterization of the But-For World for In-App Billing Services Contains Logical Flaws

299.   Dr. Gentzkow also claims "[t]he second error made by Plaintiffs' experts is that their analyses of the impact of the billing system requirement do not allow for the possibility that Google would continue to set a positive service fee for transactions using alternative billing systems in the but-for world. In fact, their market definitions and economic frameworks implicitly (and wrongly) assume but-for worlds in which Google cannot set such a fee."[662]

300.   He contends that "[t]he relevant but-for world is one where the billing system requirement is absent, but Google retains the ability to set and enforce its service fee for in-app transactions including transactions processed through non-Google billing systems"[663] and thus concludes, "[t]he correct point of comparison is the price Google charges for Google Play's billing system when it is offered separately from the services of Google Play—*i.e.*, the incremental service fee for Google Play in-app transactions involving Google Play's Billing system relative to those involving alternative billing systems."[664] He claims that Google could separate out one element of the bundle of services, allowing developers to obtain that service separately, and continue to charge developers for the remaining bundle of in-app billing services, as it purportedly did in South Korea following regulatory changes and elsewhere under its user choice billing pilot, as I explained in my Opening Report.[665,666]

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[661] Rysman Opening Report, § VII.B.2.

[662] Gentzkow Report, ¶ 550.

[663] Gentzkow Report, ¶ 553.

[664] Gentzkow Report, ¶ 548.

[665] Gentzkow Report, ¶ 548.

[666] Rysman Opening Report, ¶¶ 75, 262, 532 and footnote 249.

301.   A but-for world is one in which a defendant does not engage in the particular challenged conduct. The challenged conduct at issue in the Android In-App Billing Services Market is tying the use of Google Play Billing (tied product) to Android app distribution (tying product). As noted in my Opening Report,[667] and as Dr. Gentzkow agrees,[668] Google Play Billing is a bundle of services, which includes payment processing as well as tokenization, hosting, refunds, etc. In my but-for world, developers could choose an alternative in-app billing services provider for these services, and Google, subject to this competition, would offer a reduced commission rate in order to compete.

302.   Further, that Google is able to unbundle one element of the Google Play Billing bundle of services and continue to charge developers for the remaining elements of the bundle does not reflect a but-for world in which there is competition in the In-App Billing Services Market. As I explained in my Opening Report, the but-for service fee would be at most 15%.[669] Absent Google's challenged conduct, in unbundling the payment processing piece of the in-app billing services bundle, the amount Google claims it charges for one part of the bundle of services would be deducted from the but-for commission (*i.e.*, 15%), not the commission in the actual world in which Google's commission reflects its monopoly power.

3.   *Dr. Gentzkow's Interpretation of Developers' Demand for Alternative Billing Systems is Incorrect*

303.   Dr. Gentzkow claims that "Plaintiffs' experts … mistake evidence that some developers wish to evade Google's service fee for evidence that developers have positive demand for alternative billing systems."[670] This statement is incorrect. The very fact that developers will seek other channels for Android In-App Billing Services is evidence they have demand for Android In-App Billing Services separate from their demand for Android App

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[667] Rysman Opening Report, § VIII.A.2.

[668] Gentzkow Report, ¶ 523.

[669] Rysman Opening Report, ¶ 474.

[670] Gentzkow Report, ¶ 558.

Distribution. Developers need in-app billing services. Evidence that they would like to obtain these services from providers other than Google is evidence of separate demand.

304.   Dr. Gentzkow also states Google's commission rates "ha[ve] since fallen for most developers, and the overwhelming majority of developers who do pay service fees are now eligible to pay 15 percent (see Exhibit 6) on all their revenue."[671] However, this graphic is misleading. First, it considers only U.S. developers, yet worldwide developers produce apps downloaded from the Google Play Store by Android users worldwide (excluding China). ████

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██████████████████████████████████ But Google's pricing and revenue is better characterized by the revenue that Google's fees apply to, not the number of developers.

4.   *Dr. Gentzkow Fails to Demonstrate that Google did not Tie Google Play Billing to Distribution on Google Play*

305.   Dr. Gentzkow claims "app developers are not coerced into using Google Play's billing system as a condition of distributing their apps through Google Play," and that "[a]pp developers who use Google Play may monetize through means such as advertising that are not subject to the billing system requirement and may also collect payments for digital goods and services through other platforms or channels outside Google Play."[672] First, while developers

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[671] Gentzkow Report, ¶ 520.

[672] Gentzkow Report, ¶ 46.

may *choose* to monetize through advertising in lieu of being "coerced into using Google Play's billing system as a condition of distributing their apps through Google Play," it is in fact true that Google requires app developers who monetize through paid in-app content to use Google Play Billing for apps distributed through the Google Play Store.[673] App developers who choose to monetize through paid in-app content, and not through advertising, in a world in which Google imposes a supracompetitive fee, demonstrate a preference for monetizing through paid in-app content. Choosing this monetization strategy does not mean that the commission rate they pay is not supracompetitive. Furthermore, Google controls remuneration through advertising as well as paid content, so it is not as if advertising on the Google Play Store represents a competitive alternative.

306.   Empirical evidence on app monetization strategies rejects Dr. Gentzkow's claim that app developers often change their reliance on different monetization strategies. Using Google's monthly app and ad revenue data, I demonstrate that app developers typically choose to monetize through paid in-app content *or* advertising. ██████████████████████

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██ Explanations may be that particular monetization strategies are appropriate for different types of apps or that developers incur costs, such as reprogramming and designing an interface, that maximize revenue under a new monetization scheme.

307.   ██

██[674] Dr. Gentzkow fails to recognize that the introduction of Google Play Billing years after the launch of Android Market demonstrates product separateness because, before March 2011, Google did not

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[673] Google Play, "In-app Products," available at https://play.google.com/console/about/in-appproductssetup/ ("Developers who distribute their app through Google Play are required to use Google Play's billing system to sell digital goods or services in your app").

[674] Gentzkow Report, ¶ 80.

have its own in-app billing services to offer.[675] Dr. Gentzkow overlooks both the apps that self-supplied in-app billing services while still being available on Google Play Store and the apps Google identified as using Google Play Billing that were not distributed through the Google Play Store. All of this demonstrates separate demand for separate products.

VI.   Dr. Leonard's Damages Criticism Suffers from Numerous Flaws

A.   Overview

308.   In my Opening Report, I presented a damages model to quantify the harm to U.S. consumers from Google's challenged conduct.[676] Dr. Leonard presents a number of criticisms of my model to support his claim that my model is "flawed." I have considered Dr. Leonard's criticisms, which, as I explain below, lack merit. He misunderstands, misrepresents, and mischaracterizes much of my work and overlooks important factors demonstrating that my damages model results in a conservative estimate of damages.

309.   Moreover, Dr. Leonard's own damages model does not correctly account for his theoretical claims about pass-through.[677] It would therefore be a mistake to rely on Dr. Leonard's estimate of the pass-through rate in my calculations.

310.   In addition, Dr. Leonard's damages quantifications completely ignore any effect of Google's anticompetitive conduct on consumers through variety, and he does not even attempt to propose a "corrected" version of my variety damages quantification.[678] I conclude, therefore,

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[675] Rysman Opening Report, ¶ 73; https://android-developers.googleblog.com/2011/03/in-app-billing-launched-on-android.html.

[676] Rysman Opening Report, § IX.D.

[677] *See* Section VI.C.

[678] Interestingly, Dr. Leonard does not question that economics provides tools to quantify benefits of variety to consumers. Note that in his 2002 paper, Dr. Leonard studies the variety effect of an introduction of a new product in the bath tissue market. He uses economic tools similar to what I use to evaluate welfare effects of new varieties (although, not identical as his market and the settings are different. For example, he evaluates welfare effect of introducing one product.). He states that "T[he continuous development] and introduction of new products is an important source of improvement in consumer welfare." *See* Hausman, Jerry A. and Gregory K. Leonard, "The Competitive Effects of a New Product Introduction: A Case Study," *The Journal of Industrial Economics*, vol. 50, no. 3, 2002, pp. 237–63.

that Dr. Leonard's criticisms do not change my opinion on damages resulting from Google's challenged conduct. I explain these issues in further detail in the sections that follow.

B.   Dr. Leonard Misrepresents My Work on But-For Service Fee Benchmarking

311.   Dr. Leonard criticizes my method of benchmarking for the but-for world commission. He states that the only rationale for 15% on Android App Distribution that I put forward is that, under certain circumstances, Google offered similar rates to some developers and that in the but-for world there would be even more competition than under those circumstances. Dr. Leonard also criticizes me for not justifying uniform commissions "across all transactions, all developers, and the entire alleged damages period" in the but-for world.[679]

312.   This is a misrepresentation of the rationale behind my 15% upper bound on the but-for world commission. ██ ██ ██ ██████████████████████████████████████ ██████████████████████████████████████ ███████████████████████████████████████ ██ ████████████[680]

313.   This conservative upper bound on the but-for rate applies both to initial downloads and purchase of in-app content. With a few exceptions, Google sets the same commissions on both kinds of transactions in the actual world.[681] As for the uniform commission, I have not argued that the commission would be uniform across all transactions, all developers, and the entire alleged damages period. I have argued that 15% is a conservative

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[679] Leonard Report, ¶ 120.
[680] Rysman Opening Report, ¶¶ 535-537.
[681] Rysman Opening Report, ¶ 474-475.

estimate of the but-for commission but this does not imply a uniform commission. In the but-for world that I posit, Google's effective commission could vary, but would be at or below 15%.

314.   Dr. Leonard also misrepresents my benchmarking analyses for the but-for commission by claiming that I use other app stores' rates as benchmarks.[682]

315.   This is not what I have done. I have not used other app stores as benchmarks. I have used Google's own commission discounts as benchmarks. The information about commissions on other platforms that I lay out in my Opening Report serves as corroborating evidence rather than being the primary benchmarks on which I base my but-for commission. Dr. Leonard agrees with me that Google's own commission rates can serve as a benchmark for determining the competitive but-for commission rate. Indeed, to estimate Google's but-for commission, Dr. Leonard himself relies on Google's 15% commission on all subscriptions starting January 1, 2022 and Google's commission discount of 15% for the first $1 million of each developer's annual gross revenue. He also admits that "[w]ith Google Play serving as a benchmark for itself, economic similarity of the benchmark to the target is ensured."[683]

316.   Although Dr. Leonard agrees that Google's own commissions should be used as a benchmark, his method of estimating but-for commission is flawed. He assumes that the actual commission fee structure in 2022 would have been adopted in the but-for world from an earlier point in time.[684] This implicitly assumes that Google does not currently have market power and its current commissions are competitive.[685] However, other than subscriptions, developers currently mostly enjoy lower commission only on the first $1 million of their annual gross revenue. As I have explained in my Opening Report, in the competitive but-for world, competitive pressure on Google would be what Google has faced so far in the actual world plus

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[682] Leonard Report, § IX.

[683] Leonard Report, ¶ 178.

[684] Leonard Report, ¶ 178.

[685] Dr. Leonard's but-for rates would be appropriate if Google used to have market power but now it does not. However, Dr. Leonard does not make that case. He states that "I note that competitive pressure may exist even if there are no actual competitors in the relevant market," but does not argue that currently Google does not have market power. *See* Leonard Report, footnote 246.

additional pressure due to enhanced competition.[686] Many developers would become more price sensitive as they would have more alternatives from which to choose and switch if desired. Developers would have an increased ability to find a substitute to Google Play or its billing system, and according to the evidence discussed in my Opening Report, this would discipline Google's price setting power and hence its commission.[687]

317.   Finally, Dr. Leonard notes that my "15% but-for service fee rate is inconsistent with Dr. Singer's but-for service fee (23.4%) based on the Singer combined market take rate model. Dr. Rysman's overcharge damages calculation would be reduced by over half if he were to use Dr. Singer's 23.4% but-for service fee rate."[688] Dr. Singer estimates 23.4% as an alternative scenario "[i]n the event that the factfinder concludes that the Android App Distribution Market and In-App Aftermarket are not two separate markets…"[689] Hence, his results are not directly comparable to mine as I do not consider a scenario in which Android App Distribution Market and In-App Aftermarket are the same market, having determined that each is a well-defined relevant antitrust market. In other words, this is not an apples-to-apples comparison of the results arrived at by me and Dr. Singer.[690]

C.   Dr. Leonard's Pass-Through and Developer Marginal Cost Criticisms Are Irrelevant

318.   A large part of Dr. Leonard's criticism is devoted to the pass-through rate. In economics, in some common pass-through analyses, one would study the effect of marginal cost

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[686] Rysman Opening Report, ¶ 473.

[687] Rysman Opening Report, ¶ 472.

[688] Leonard Report, ¶ 121.

[689] Singer Merits Report, p.132.

[690] For the sake of comparison, I run my damages model and estimate welfare effects under the assumption of 23.4% but-for commission. *See* results in Rysman Rebuttal Report Backup Production.

on price or the effect of ad valorem tax (fee) on price.[691] One would study how changes in marginal cost (or ad valorem fee) are passed through to price, and thus to consumers. However, what Dr. Leonard refers to as pass-through in my model is actually the ratio of a change in the app's price to the change in the amount paid to Google in commission. The amount paid to Google equals the price the app charges times the commission rate. Using this definition of pass-through, Dr. Leonard emphasizes that the pass-through rate under a version of the CES model is unparameterized. However, he does not acknowledge that the effect of the commission rate on the price in the CES model depends on the elasticity, as it should. In what follows, I use pass-through to refer to the same object as Dr. Leonard (the equilibrium relationship between the change in price and the change in the amount paid to Google) for clarity.

319.   Dr. Leonard claims that my "overcharge damages calculations" are "flawed" because I have assumed a "100% service fee pass-through rate."[692] However, Dr. Leonard misrepresents my model. There is no place in my report where I state that the pass-through rate of service fees is 100%. My report takes no position on the pass-through rate. I focus on results with a 100% pass-through rate in my SSNIP test to be conservative and a 0% pass-through rate in my damages calculation to be conservative. My approach to the SSNIP is conservative because the more apps pass through the hypothetical monopolist's commission increase, the more that total quantity decreases and the less likely the requirements of the SSNIP are satisfied. Similarly, I consider damages estimates for 0% and 100% pass-through rates ("Variety Effects" and "Total Damages" versions in my Opening Report) and show that 0% presents the lower damages estimate between the two, which I chose as my damages estimate to be conservative. The fact that 0% would be conservative is intuitive: when the commission rate goes from 30% to

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[691] Jaffe, Sonia and E. Glen Weyl. "The First-Order Approach to Merger Analysis." *American Economic Journal: Microeconomics*, Vol. 5, No. 4, 2013, pp. 188–218, at 204-205; Bulow, Jeremy I. and Paul Pfleiderer, "A Note on the Effect of Cost Changes on Prices," *Journal of Political Economy*, Vol. 91, No. 1, 1983, pp. 182-185. Dr. Leonard also agrees that "[t]he economics literature has extensively studied marginal cost pass-through." *See* Leonard Report, ¶ 31. For a study of the effect of ad valorem tax on price *see e.g.,* Anderson, Simon P., André de Palma, and Brent Kreider, "Tax Incidence in Differentiated Product Oligopoly," *Journal of Public Economics*, Vol. 81, No. 2, 2001, pp. 173–192. Dr. Leonard also discusses ad valorem fee which is Google's commission rate. *See* Leonard Report, ¶ 32.
[692] Leonard Report, ¶¶ 122, 125.

15%, consumers benefit most if there is both a price effect and a variety effect. With 0% pass-through, there is only a variety effect, which is larger than with pass-through, but not enough to offset the price effect.[693] Thus, a 0% pass-through provides a conservative bound on damages.

320.   Thus, because my model is flexible and can accommodate any pass-through rate, my approach is to make conservative assumptions rather than to attempt to determine the actual pass-through rate. It is straightforward to recalculate the SSNIP test and damages model under the proposed pass-through rates of other experts and I do so in this report.

321.   Dr. Leonard presents several mechanisms that he claims could lead to low pass-through rates. If I had wanted to evaluate pass-through rates, I would have developed a model with mechanisms to address pass-through. Indeed, it is standard in economic modeling to strip out any features of the model that are not necessary to achieve the goals of the model. Because I did not use my model to evaluate pass-through but rather imposed conservative assumptions about pass-through, I did not include modeling features about pass-through.

322.   Interestingly, Dr. Leonard's proposed mechanisms for why observed pass-through should be low [694] show that his estimated pass-through rates are not appropriate to incorporate into the SSNIP test and damages analysis.

323.   First, Dr. Leonard argues that focal point pricing might lead to low pass-through rates of the commission. But Dr. Leonard's argument is misguided. Focal point pricing refers to the fact that apps tend to be priced at values that end in 0.99 or .9. Dr. Leonard's argument is that even if, absent focal point pricing, small commission changes would lead to small price changes, focal point pricing will imply that when the commission rate changes, apps will not want to make the jump to the next price level and so we will observe low pass-through.[695] However, this is not correct. While I have not analyzed whether this market is characterized by focal point

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[693] *See* Rysman Opening Report, footnote 1137 where I explain the intuition for why the variety effect when firms do not adjust prices to commission changes would be larger than the variety effect when firms adjust prices in response to commission changes.

[694] Leonard Report, ¶ 31.

[695] Leonard Report, ¶ 31-32.

pricing, even assuming focal point pricing, some firms would be on the margin between choosing the lower price and the higher price. In response to a change in the commission rate, they may make the jump to a different focal point price level. Thus, while some firms would not change price in response to a change in the commission rate, some firms would make much larger price changes than we would see absent focal point pricing. The overall effect is that focal point pricing could lead to larger or smaller pass-through rates than without focal point pricing. Dr. Leonard's failure to understand the implications of focal point pricing calls into question his analysis of pass-through.

324.   For example, suppose there are 2 apps – both charging $2 and each selling one item. Suppose there is a restriction that allows them to charge only prices that are whole dollars (e.g., $1, $2, $3, etc.). Suppose that, after the commission decreases, the profit maximizing price for one app is $1.9 and for the other app it is $1.3. The first app is unlikely to drop price to $1 from its actual price as the profit maximizing price is closer to $2 than it is to $1. The reverse is likely for the other app. So, the average price would likely be ($1.9+$1.3)/2=$1.6 if there were no requirement to change prices that are whole dollars. However, under the restriction, the average price would be even lower: ($2+$1)/2=$1.5. Then, assuming the commission dropped from 30% to 15%, the pass-through of commission with respect to the average price in the first case would be: ($1.6-$2)/(0.15*$1.6-0.3*$2)=$1.11 and the pass-through in the latter case would be: ($1.5-$2)/(0.15*$1.5-0.3*$2)=$1.33. Hence, the restriction would imply higher pass-through.

325.   Dr. Leonard's second explanation for low pass-through rates is that developers may face frictions to changing price, such as a fixed cost that a developer must pay to change a price.[696] Economists sometimes refer to the cost of changing price as a menu cost, which is meant to refer to the cost to a restaurant of printing new menus each time it changes a price.[697] Economic models often predict that firms should adjust price immediately in response to any

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[696] Leonard Report, ¶ 31.

[697]Golosov, Mikhail, and Robert E. Lucas Jr., "Menu Costs and Phillips Curves," *Journal of Political Economy*, Vol. 115, No. 2, 2007, pp. 171–199; Kenton, Will, "What Are Menu Costs? Definition, How They Work, and Example," Investopedia, October 28, 2021, available at https://www.investopedia.com/terms/m/menu-costs.asp.

change in demand or marginal cost, and menu costs provide an explanation for why price changes may be less frequent.

326.   It is not clear that menu costs should play a role in a SSNIP test or damages analysis. The kind of frictions that Dr. Leonard points out would be relevant once the initial price had already been set and a developer needs to decide whether to change that price. That is, those frictions would cause price stickiness in the sense that a developer would find it difficult or costly to *change* prices. However, in a sensible but-for world, Google would have set lower rates throughout the at-issue time period so app developers may have chosen lower prices from the start. The computation of damages is meant to reflect a counterfactual world in which Google charges lower rates for the entire time period at issue, not a world in which Google started with a monopoly commission rate and then changed to a competitive one. To the extent that menu costs should not be accounted for in damages calculations, the pass-through rates that Dr. Leonard proposes, which he states reflect menu costs, should not be applied to the damages calculation. Ultimately, my proposed level of damages is robust to different pass-through rates, so the determination of this issue is not critical to my analysis.

327.   With regard to the SSNIP test, for instance, it would never be profitable for a firm with high enough menu costs to raise its price from the competitive level (or indeed, from any level). Thus, if we accounted for menu costs in a SSNIP test, even a set of products that faced no substitutes and were protected by high barriers to entry would not be found to be a relevant market just because of the existence of the menu costs. But that runs counter to the goals of the test. Thus, we should think about the SSNIP test from the ex-ante perspective (*i.e.* hypothetical monopolist and developers setting initial prices rather than changing prices).

328.   Thus, to the extent the menu costs should not be accounted for in damages and SSNIP calculations, the pass-through rates that Dr. Leonard proposes, which he states reflect menu costs, should not be applied to these calculations. I provide calculations of both the SSNIP and welfare effects using his proposed pass-through rates, but I do so for the sake of completeness, not because I endorse his approach. Given that calculating pass-through rates that are appropriate for a SSNIP or damages calculation is challenging, I prefer my approach of using a conservative pass-through rate of 0% for damages and 100% for the SSNIP. In addition, for the sake of comparison, I also conduct the SSNIP test and welfare effects calculations using Dr.

Singer's pass-through estimate. They show that calculating welfare effects using a 0% pass-through rate (variety effects) that I have proposed in my Opening Report is the most conservative version.[698]

329.   Dr. Leonard points out that, in the context of apps, one could also end up with a negative pass-through if one thinks about a developer's trade-offs when considering an ad-supported revenue model that developers can use as an alternative to the paid model (paid download, subscription, or other IAP).[699] However, Dr. Leonard does not measure substitution between the two models or provide other evidence on the extent of their interaction in this matter.[700] I understand that the bounds I consider (0% and 100%) encompass all of the pass-through rates put forward by experts in this case.

330.   Dr. Leonard's discussion of marginal costs is also flawed. He criticizes some of the examples of potential marginal costs that I lay out in my Opening Report.[701] But his definition of marginal costs is not standard. Economists define marginal costs to be costs that increase as a result of increasing the quantity of production, as opposed to fixed costs which do not depend on quantity.[702] However, Dr. Leonard seems to suggest that marginal costs are only those that affect pricing.[703] In the context of focal point pricing or menu costs, which Dr. Leonard thinks are important for apps, changes in marginal cost may not be reflected in price. Dr. Leonard says that my analysis "confuses marginal costs with (average) variable cost." It is as

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[698] *See* Rysman Rebuttal Report Backup Production. In addition, in response to Dr. Leonard's concern that I do not account for COVID-19's effect on sales in my projections of sales to extrapolate damages to June 5, 2023 (Leonard Report, footnote 158), I rerun projections using only the most recent pre-COVID-19 data from 2018 to 2019. The results show that the welfare effects for the period August 16, 2016 to June 5, 2023 are about 4% lower if I account for the COVID-19 pandemic (*See* Rysman Rebuttal Report Backup Production). Dr. Leonard goes further and states that "[r]ather than calculating damages on unsupported sales projections, Dr. Rysman could calculate damages based on the actual sales data when those data become available." (Leonard Report, footnote 158).

[699] Leonard Report, ¶¶ 31-33. *See also*, ¶¶ 122-126; Appendix E, ¶¶ 8-14.

[700] Interestingly, Dr. Leonard's pass-through estimate does not come up to be negative and statistically significant. *See* Leonard Report, ¶¶ 51.

[701] Leonard Report, ¶¶ 128-132.

[702] *See e.g.,* Mankiw, N. Gregory, Principles of Microeconomics, Fifth Edition, Mason, OH: South-Western CENGAGE Learning, 2008 (hereafter "Mankiw (2008)"), pp. 274-276.

[703] Leonard Report, ¶ 129.

if Dr. Leonard believes that a cost can be part of variable cost but not marginal cost. But variable cost is defined to be the sum of marginal costs over the units produced. If the marginal costs of the first three units produced are 6, 5, and 4, the variable cost of the first three units is 15 (because 6+5+4=15). It is impossible that a cost could be part of variable cost and not marginal cost. Similarly, average variable cost is simply variable cost divided by quantity. Thus, it is similarly impossible that a cost could be part of average variable cost and not marginal cost. This confusion leads Dr. Leonard to make puzzling statements such as: "[a]s a firm grows and serve[s] more customers, certain cost categories may increase as well. However, the marginal cost associated with a small increase in sales may still be zero or near zero."[704] He seems to want to have it both ways: he admits that costs go up as a firm increases in size but denies that marginal cost is positive. This is contradictory. To the extent that his discussion points to a possible lumpiness of marginal costs (*e.g.,* if in the example above, marginal cost of the first three units produced are 0, 0, and 15), he presents no evidence that this important in this setting. In addition, in economics it is not a common practice to model lumpy marginal costs.[705]

331.   Getting to the bottom of what is marginal cost and what is not is not critical. The only technical requirement for my model with regard to marginal cost is that it is any value greater than zero. Dr. Leonard acknowledges this point ("the assumptions of [Rysman's] model require that marginal cost must be positive for all apps."),[706] and nevertheless, he does not contend that marginal costs are zero. Indeed, he states that "marginal cost tends to be small and even negligible in some cases for digital goods is well-recognized" and provides sources to support his statement.[707] None of the three academic sources that he cites claim that marginal costs are exactly zero. Dr. Leonard further relies on testimony from Mr. Sweeney, the CEO of

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[704] Leonard Report, ¶ 129.

[705] An example of lumpy cost would be when more workers are needed to produce more output but a firm would not necessarily hire an additional worker (or labor hour) for each additional unit produced. Indeed, none of the papers that Dr. Leonard cites in ¶ 127 of his report study lumpy marginal costs.

[706] Leonard Report, ¶ 128.

[707] Leonard Report, ¶ 127.

Epic Games, that the marginal cost of V-Bucks (an in-game currency) is zero.[708] However, that is not sufficient to argue that the marginal cost of additional consumers is zero. Even within the narrow evidence that Dr. Leonard relies on, V-Bucks have no value to players by themselves. V-Bucks are used to purchase in-game accessories such as enhancements to characters that players control. To the extent that these enhancements rely on downloading new code, they require hosting and internet transmission, which has a cost.

D.   Dr. Leonard Misunderstands and Mischaracterizes My Damages Quantifications

332.   Dr. Leonard states that "Dr. Rysman offers… a variety damages calculation (that assumes that the number of apps would have been higher in the but-for world than the actual world, but that the service fee rate would have been the same), and a hybrid calculation (that assumes that both the number of apps would have been higher and the service fee rate would have been lower in the but-for world than in the actual world)."[709] This is not correct. Dr. Leonard misunderstood my calculations of damages.

333.   My variety damages calculation does not assume that "service fee rate" is fixed. In such a case, the model would not predict an increase in the number of apps due to a lower commission (or "service fee rate" as Dr. Leonard calls it). Instead, my variety damages calculation assumes 0% "pass-through" (*i.e.,* that app and in-app content prices would not drop in the but-for world, but the "service fee rate" would). On the other hand, my "hybrid calculation" relaxes that assumption and allows both the unique number of apps and prices to respond to changes in Google's commission in the but-for world.

E.   Dr. Leonard's Criticism That My Model Does Not Account for Ad-Supported Apps is Speculative and Without Merit

334.   Dr. Leonard notes that my model does not account for free and ad-supported apps. He asserts that "[t]his omission is problematic because some of the increased 'variety' in paid

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[708] Leonard Report, ¶ 130.
[709] Leonard Report, ¶ 118.

apps that Dr. Rysman claims would have entered may in fact just have been apps switching from being free or ad-supported to being paid."[710] Dr. Leonard's claim is speculative and baseless. He does not provide any evidence to support his claim. For example, he does not provide an estimate of substitution between advertising and paid models. █████████████████████████████

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335.   In addition, to the extent that some apps would switch monetization strategy from ad-supported to paid, new free apps with ad-supported monetization strategy would likely enter to fill the place of existing free apps. Thus, my damages model can be viewed as conservative in this regard as it does not account for the latter.

F.   Dr. Leonard's Heterogeneity Criticisms are Misplaced

336.   Dr. Leonard criticizes me for using a "highly stylized model… [that] will not be suitable for quantitatively assessing damages in a real-world context."[712] He criticizes me for the symmetry assumption I make and states that it is not consistent with the reality and that my model would not be workable if that assumption were relaxed.[713] Below, I provide various evidence and economic arguments showing that Dr. Leonard's criticism is incorrect.

337.   Before I consider Dr. Leonard's specific arguments and evidence, it is helpful to emphasize that an economic model must necessarily operate at some level of generality. To make it tractable to answer complicated economic questions, economists build models that set aside immaterial details and focus on the most important aspects that pertain to a given question

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[710] Leonard Report, ¶ 137.

[711] *See* Exhibit 4.

[712] Leonard Report, ¶¶ 134-135.

[713] Leonard Report, ¶¶ 140-154.

under consideration.[714] Dr. Leonard's criticism that my model is stylized and abstracts from various heterogeneity misses this point.

338.   Especially when studying large economic systems, economists often use a small number of parameters in their models. For example, as I explained in my Opening Report, the constant elasticity of substitution (CES) assumption has been used when studying trade between countries for a wide variety of differentiated goods, including in papers published in the most highly regarded economic journals.[715] In addition, it has been a general trend in macroeconomics to use a few parameters for models of economies that represent aggregations across large varieties of consumers and firms.[716]

339.   Google manages an app store with millions of apps and developers. Because the pricing and entry decisions are made for millions of apps that are not perfect substitutes for each other, I deem it most appropriate to approach modeling of the many differentiated products akin

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[714] *See e.g.,* Mankiw, N. Gregory, Principles of Microeconomics, Fifth Edition, Mason, OH: South-Western CENGAGE Learning, 2008 (hereafter "Mankiw (2008)"), pp. 23-24 ("economists assume away many of the details of the economy that are irrelevant for studying the question at hand. All models… simplify reality to improve our understanding of it.").

[715] Rysman Opening Report, ¶ 581 *See also,* Helpman, Elhanan, Marc Melitz, and Yona Rubinstein. "Estimating trade flows: trading partners and trading volumes," *Quarterly Journal of Economics*, Vol. 123, No. 2, 2008, pp. 441-487; Bernard, Andrew, B., Jonathan Eaton, J. Bradford Jensen, and Samuel Kortum, "Plants and Productivity in International Trade," *American Economic Review*, Vol. 93, No. 4, 2003, pp. 1268-1290; Eaton, Jonathan, and Samuel Kortum. "Technology, Geography, and Trade." *Econometrica*, Vol. 70, No. 5, 2002, pp. 1741–1779. (hereafter "Eaton and Kortum (2002)."). Importantly, Eaton and Kortum (2002) estimate their model using bilateral trade in manufactures for a cross-section of 19 OECD countries in 1990 (p. 1742) which is a much broader level of aggregation than I use.

[716] *See e.g.,* Hansen, Gary D., "Indivisible labor and the business cycle," *Journal of Monetary Economics*, Vol. 16, Issue 3, 1985, pp. 309-327 (hereafter "Hansen (1985)"); Hsieh, Chang-Tai, and Peter J. Klenow, "Misallocation and Manufacturing TFP in China and India," *The Quarterly Journal of Economics*, Oxford University Press, Vol. 124, No. 4, 2009, pp. 1403-1448 (hereafter "Hsieh et al (2009)") (the authors assume the industry aggregate output is represented by CES aggregate function. Although, they state that their "single σ [CES parameter] is a strong simplifying assumption," (*see* at p. 1414) they still use a conservative estimate of the parameter for their calculations by choosing it "conservatively at the low end of empirical estimates." (*see* at p. 1425). Importantly, Hsieh et al (2009) use a single CES parameter to represent much broader industries than I do. In particular, they apply their model to industries represented by 4-digit ISIC codes. Examples of 4-digit ISIC codes are 6201 (Computer Programming Activities) and 5820 (Software Publishing). *See* Siccode, "ISIC (International) for 'software'," available at https://siccode.com/search-isic/software. Developing apps for Android would be only a small share of these categories. *See also* Atkeson, Andrew and Ariel Burstein, "Aggregate Implications of Innovation Policy," *Journal of Political Economy,* 2019, Vol. 127, No. 6, pp. 2625-2683.

to a model of a large economy. If I were asked to study, for example, a merger between two firms, the types of questions I would need to answer, the level of abstraction, and the focus would be different from the current case. Fine details about exactly how substitutable the products of those two firms are relative to other nearby products would be more relevant for such analyses and thus the modelling approach would likely be different from the current case.

340.   Given the above and the goal of understanding and quantifying the welfare effects of Google's conduct at the aggregate level, I chose a workhorse model in economics that has been used by numerous authors over several decades. A model of monopolistic competition describes a market structure with many firms selling products that are similar but not identical. Product differentiation provides price setting power to the firms (as opposed to firms being price-takers as under perfect competition) and leads to non-zero markups over marginal cost. Firms do not have as much pricing power as a monopolist would have and hence the market structure lies somewhere between monopoly and perfect competition.[717] Differentiated products also imply consumer surplus from the introduction of new products and thus consumers value variety. In the long run, there is entry of new firms in a monopolistically competitive market as long as firms make non-zero long-run profits. This process determines the number of products in the market and the welfare that consumers obtain from the market.[718]

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[717] It is closer to perfect competition compared to duopoly or oligopoly models. *See e.g.,* Mankiw (2008), p. 347: (explaining that "oligopoly and monopolistic competition are quite different. Oligopoly departs from the perfectly competitive ideal… because there are only a few sellers in the market. The small number of sellers makes rigorous competition less likely and strategic interactions among them vitally important. By contrast, under monopolistic competition, there are many sellers, each of which is small compared to the market.").

[718] Mankiw (2008), pp. 345-354; Church, Jeffrey and Neil Gandal. "Complementary network externalities and technological adoption," *International Journal of Industrial Organization*, Vol. 11, No. 2, 1993, pp. 239-260 (hereafter "Church and Gandal (1993)"); Dixit, Avinash K. and Joseph E. Stiglitz, "Monopolistic Competition and Optimum Product Diversity," *The American Economic Review*, Vol. 67, No. 3, 1977, pp. 297-308 (hereafter "Dixit and Stiglitz (1977)"); Nair, Harikesh, Pradeep Chintagunta, and Jean-Pierre Dubé, "Empirical Analysis of Indirect Network Effects in the Market for Personal Digital Assistants," *Quantitative Marketing and Economics*, Vol. 2, 2004, pp. 23–58 (hereafter "Nair et al (2004)"); Hsieh et al (2009).

1. Dr. Leonard Incorrectly Claims That My Model Incorporates Only Two Empirically Determined Figures

341.   Dr. Leonard claims that my damages work depends "crucially" on only two "inputs": the but-for commission and the own price elasticity of demand parameter.[719] This mischaracterizes my model. In addition to those two parameters, my damages model depends on Google's actual world commission, actual world and but-for discounts to consumers, developer fixed costs, and consumer expenditure on app and in-app content. All those are empirically determined figures.

342.   In addition, to calibrate a developer's fixed cost, I use information on the number of apps on Google Play in the actual world. I also conduct regressions to estimate own-price elasticity of app and in-app demand (although, to be conservative, I use the elasticity from the literature) where I use data on app and in-app content prices, the number of transactions, and tax rates. In those regressions, I control for app, time, and purchase type (paid download, subscription, and other IAP) fixed effects, which represent thousands of fixed effects. All those fixed effects are additional parameters that determine my estimate of elasticity. Thus, Dr. Leonard's characterization of my work is misleading, incorrect, and oversimplified.

2. Dr. Leonard Incorrectly Claims That Many Apps Generate Revenue Through the Sale of Multiple Products

343.   Dr. Leonard criticizes me for assuming that "each app generates revenue through the sale of a single 'product' at a single 'price.'"[720] Dr. Leonard claims that I do not distinguish between IAP, download, and subscription prices and that "[t]he demand curves, costs, or pass-through for these different products may well be different." He further claims that "[m]any apps generate revenue through the sale of multiple products, such as the initial download and IAP."[721] There are several problems with Dr. Leonard's criticism.

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[719] Leonard Report, ¶134; Leonard Report, Appendix E, ¶¶ 2-3.
[720] Leonard Report, ¶ 139.
[721] Leonard Report, ¶ 139.

344.   First, his claim that "[m]any apps generate revenue through the sale of multiple products, such as the initial download and IAP" is baseless and simply wrong. ███████

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Exhibit 23

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Notes:

1. In-app transactions include subscriptions and other in-app content.
2. Year 2016 figures start from August, 2016.
3. Excludes observations that had negative values or zero for transaction volume, negative values or zero for net consumer expenditure net of developer discount. Also, excludes observations with price greater than $400, where price is calculated by dividing net consumer expenditure net of developer discount by transaction volume.
4. This table only keeps device types that are phones, tablets, or missing/null/unknown.

Source: Google Monthly App Revenue Data.

345.   Second, Dr. Leonard does not discuss or show the importance or implications of considering IAP, download, and subscription prices separately and then aggregating the model to generate aggregate damages rather than analyzing aggregate market to start with. Dr. Leonard also ignores the fact that in my demand estimations I controlled for app purchase-type fixed effects (download, subscription, and other in-app). This means that in my regressions I accounted for the potential effects of the purchase type on demand.

346.   Finally, as I have discussed above, it is common in economics to use a single CES parameter to represent much broader industries (and categories of goods) than I do.

3.   *Dr. Leonard's Description of Heterogeneity Across Apps Is Redundant*

347.   Dr. Leonard claims that "Dr. Rysman assumes that all apps have the same quality parameter, the same demand function, the same marginal cost, the same entry cost, the same

price, and the same quantity of sales. Without this 'symmetry' assumption, Dr. Rysman's model would be unworkable."[722] He further provides descriptive data showing that apps charge different prices and have different levels of sales and usage.[723] This criticism is redundant and without clear and empirically supported conclusions about the implications of heterogeneity for aggregate damages.

348.   First, Dr. Leonard does not properly acknowledge my discussion of heterogeneity and why my approach is robust to it in certain aspects.[724] As I showed in my Opening Report, under the assumption of heterogenous marginal costs and quality across apps, where apps know exactly about their quality and marginal costs, and price accordingly, the resulting equation for average price closely approximates the pricing equation that I derive from my model. In addition, in my Opening Report I have accounted for heterogeneity on the demand (consumer) side by using variation in sales tax rates, prices, and transactions to estimate own-price demand elasticity. In my estimation, I also controlled for app, time, and purchase type (paid download, subscription, and other IAP) fixed effects.

349.   Second, to further show the robustness of my results, in Appendix C I extend my baseline damages model to explicitly allow for heterogeneity in marginal costs and app quality. I show that, under the assumption that app quality and marginal costs are uncertain and completely unpredictable, for the purpose of estimating aggregate damages, my results would be unchanged. The equations, to estimate aggregate damages, that I obtain from the model that explicitly starts with the heterogeneity assumptions, unpredictability assumption, and a large economy assumption (*i.e.* a large number of firms), are the same as the equations that I obtain from my baseline model under the homogeneity assumptions, unpredictability assumption, and a large

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[722] Leonard Report, ¶ 140.

[723] Leonard Report, ¶¶ 140-144.

[724] Rysman Opening Report, ¶ 572 ("I show in Appendix F that the pricing equation that I derive closely approximates the average pricing equation that would arise in a model with heterogeneous marginal costs. While the costs discussed above may vary across different apps, the predicted price from my model approximates the average price that would arise, in that setting."); Rysman Opening Report, Appendix F footnotes 7-8.

economy assumption. Thus, it does not matter whether I model heterogeneity in quality and marginal cost or use the "aggregate" or "average" model. This analysis also shows that Dr. Leonard's claim that my model is unworkable without symmetry assumption is wrong.

350.   Third, Dr. Leonard's reading of my model and assumptions is too literal. As I have explained above and shown in Appendix C, my model is tailored to study the aggregate welfare effects in an economy with a large number of differentiated products. The point of my model is that consumers benefit from more choices and to measure that benefit. To the extent I rely on symmetry, it is an abstraction. Dr. Leonard's evidence shows how quantity, prices, and usage are different across apps. I do not dispute that. However, this evidence does not rebut my model and completely misses the point and objective of my analysis. The objective is to understand if and how aggregate welfare was harmed as a result of Google's conduct. In order to answer this question, one should look at the market in the aggregate and from an ex-ante perspective (*i.e.,* before apps would make their initial entry decisions) and use ex-post (*i.e.,* after apps have entered the market) heterogeneity explicitly whenever necessary for the analyses. For example, as discussed above, for estimating the own-price elasticity of demand, I explicitly used variation in ex-post (or realized or actual) quantities, prices, and sales taxes. I also controlled for app fixed effects (among other factors) to account for potential quality heterogeneity across apps.[725] Thus my own-price elasticity of demand estimate accounts for the variation in all those variables because my regression uses the heterogeneity across apps to generate the estimate.

> 4.   *Dr. Leonard Purports That the Assumption of Ex-Ante Unpredictability of App Quality Is Incorrect*

351.   Dr. Leonard criticizes my assumption of ex-ante symmetry (*i.e.*, app developers cannot predict their success before creating an app and entering an app store) based on a combination of mostly irrelevant evidence and unsupported arguments.

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[725] *See* Rysman Opening Report, § IX.C describing my regression model.

a)   Dr. Leonard's Criticism that the Average Quality of New Apps Would be Lower is Without Basis

352.   Dr. Leonard's claim that average quality of new apps would be lower is baseless.[726] He does not support his claim with any empirical analyses or other evidence. His oversimplistic model with asymmetric ex-ante quality is also baseless and constructed in a circular way *i.e.,* the result is obtained by construction of the model. He assumes parameter values for the model such that the model generates the results that he desires (rather than estimating parameters from the data or obtaining sensible and conservative estimates from the literature).[727] For example, one of the assumptions of Dr. Leonard's model is that there is a fixed number of potential entrant apps. In Dr. Leonard's model, when Google's commission decreases from 30% to 15%, by construction, there are no more high-quality apps available to enter the market and thus it is either the case that low quality apps enter, or no additional entry occurs. [728]

353.   Dr. Leonard also completely misses the point that enhanced competition generally improves product quality rather than reducing it.[729] Under the enhanced competition, firms compete more aggressively for customers and tend to offer better products, among other benefits. Given this simple intuition and evidence, one might expect average app quality to increase in the

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[726] Leonard Report, ¶ 151.

[727] Leonard Report, Appendix E, ¶¶ 35-40

[728] *See* Leonard Report, Appendix E, ¶ 38. ("Thus, despite the lower commission rate, there would be no additional variety in the 'real world' with quality asymmetry. The reason for this is that the apps that did not enter with the higher commission rate are those with relatively low quality. Even with the lower commission rate, they are not profitable because of their lower quality. There is a 'selection problem'—the apps that entered are of higher average quality than the apps that did not enter.").

[729] *See e.g.,* Boushey, Heather and Helen Knudsen, "The Importance of Competition for the American Economy," *The White House*, July 9, 2021, available at https://www.whitehouse.gov/cea/written-materials/2021/07/09/the-importance-of-competition-for-the-american-economy: ("Basic economic theory demonstrates that when firms have to compete for customers, it leads to lower prices, higher quality goods and services, greater variety, and more innovation."); Matsa, David A., "Competition and Product Quality in the Supermarket Industry," *The Quarterly Journal of Economics*, Volume 126, No. 3, 2011, pp. 1539–1591(noting that "[t]he risk that customers will switch stores appears to provide competitors with a strong incentive to invest in product quality.") p. 1539; Busso, Matias and Sebastian Galiani, "The Causal Effect of Competition on Prices and Quality: Evidence from a Field Experiment," *American Economic Journal: Applied Economics*, Vol. 11, No. 1, 2019, pp. 33-56 (showing that competition increases quality of products that consumers perceive) at p.36.

but-for world rather than decrease. This indeed would suggest that my approach can be regarded as conservative because my model implies that average app quality remains unchanged.

                b)   Dr. Leonard's Criticism that Janßen et al. (2022) Does not Support the Assumption of Unpredictability Is Flawed

354.   Dr. Leonard claims that Janßen et al. (2022) is not applicable to support the assumption of unpredictability of app success (or quality) in this case.[730] His arguments are without basis.

355.   First, Dr. Leonard notes that Janßen et al. (2022) "included all apps the authors were able to collect from Google Play store, free, ad-supported, paid, subscription or IAP-based." Further, he states that "[b]ecause the Janßen, et al. (2022) study did not perform any targeted study on paid apps or apps with IAPs, there is no analogous evidence for the apps Dr. Rysman focused on exclusively."[731] However, it is not clear what the standard for "analogous evidence" represents for Dr. Leonard. He does not explain this standard, nor does he discuss the implications of using a result based on Janßen, et al. (2022) data. Results from Janßen, et al. (2022) are useful for learning about the Play Store even though their data set is not exactly the same as the one I use (*i.e.*, I use Google Transaction Data which was produced without information about free apps).

356.   Second, Dr. Leonard notes that "the authors of the study [Janßen, et al. (2022)] noted that their results did suggest partial predictability." He further purports that "Dr. Rysman failed to assess how robust his damages calculations would be under partial predictability."[732] Dr. Leonard fails to acknowledge that complete unpredictability is the main result (baseline model) in Janßen, et al. (2022) and partial unpredictability is a sensitivity.[733] I do not have to replicate sensitivities in the paper in order to rely on its main finding. In addition, it is worth

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[730] Leonard Report, ¶ 149-150.

[731] Leonard Report, ¶ 150.

[732] Leonard Report, ¶ 150.

[733] Janßen, Rebecca, Reinhold Kesler, Michael E. Kummer, and Joel Waldfogel, "GDPR and the Lost Generation of Innovative Apps," NBER Working Paper Series, 2022 (hereafter "Janßen et al (2022)"), at p. 30.

noting that the authors hold themselves to a very high standard in testing for the predictability of quality. They test for the equality of the reduction in the number of apps and the usage of apps (*i.e.,* based on volumes of user ratings or cumulative installations), and regard any evidence that usage went down by less than the number of apps as evidence of predictability. However, if the number of new apps falls, we might expect apps that still enter the market to have higher usage even if the new apps have the same quality distribution just because there are fewer apps in the market. Moderate increases in usage could still be consistent with no predictability. Given the small differences between the usage rate and app entry even in their most unfavorable statistics (which they view as a sensitivity), I do not see evidence in favor of important app success predictability.

357.   Finally, Dr. Leonard states that "GDPR increased uncertainty for many developers" and further speculates that this uncertainty "coupled with the penalty structure of General Data Protection Regulation (GDPR) may drive out both ex-post successful and ex-post unsuccessful apps, even if app success is predictable. Because violating GDPR could result in fines to developers up to a proportion (4%) of annual revenue (or 20 million EUR, whichever is larger), if app success is in fact predictable, uncertainty related to compliance can drive out precisely the predictably successful apps."[734] However, this is flawed for several reasons. First, suppose one believes that GDPR increased uncertainty in a similar way for high- and low-quality apps. If the quality of an app is predictable then (according to Dr. Leonard's intuition stemming from his model, with asymmetric quality and perfect predictability, in Appendix E) one should see a decrease in the entry of the low-quality apps relative to the high-quality apps. However, the main result of Janßen, et al. (2022) suggests that that entry decreased in the same proportion for all apps.[735] So, this means that quality is not predictable. Second, the story that the penalty structure may drive out predictably successful apps more than predictably less successful is counterintuitive. Under the penalty structure, if anything, one would expect that predictably less

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[734] Leonard Report, ¶ 150.
[735] Janßen, et al. (2022), pp. 22-24, 30.

successful apps would be driven out more than predictably successful apps. This is because a 20 million EUR fine for violating GDPR would be a far higher burden for less successful apps with low revenues compared to a penalty of 4% of annual revenue for large apps. Even if one considers Dr. Leonard's counterintuitive conclusion that the penalty structure would drive out predictably successful apps, it may well be that predictably successful apps would have stronger incentives to mitigate risks associated with GDPR compliance which would make it more likely that they would not be driven out and hence mitigate Dr. Leonard's concern.

358.   Dr. Leonard also cites to several sources suggesting that venture capital firms, large developers, and researchers try to predict app success.[736] While these represent individual cases, my opinion is that the results of Janßen et al. (2022) provide a good approximation to the unpredictability assumption as it pertains to the Google Play Store in its entirety. The paper also directly uses entry (which is directly relevant for my model) to study whether app success is predictable, finding that success is unpredictable in the sense that the distribution of app quality would likely remain unchanged after a shock to developer costs. Hence, the average quality would likely remain unchanged.

359.   In conclusion, Dr. Leonard's criticism that Janßen et al. (2022) is not applicable to support the assumption of unpredictability of app success (or quality) in this case, is based on arguments that do not change my opinion.

<div style="text-align:center;">

c)   Dr. Leonard's Claim That Malicious Apps Would Lower Consumer Welfare in the But-for World is Speculative

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360.   Dr. Leonard purports that I "failed to recognize" that malicious apps could enter in the but-for world.[737] As explained above, because app success is unpredictable, Janßen et al. (2022) found that increased GDPR costs did not change the mix of successful and unsuccessful apps. Similarly, a reduction in the commission rate likely would not change the total mix of "good" and "bad" apps and hence the average app quality would remain unchanged. For Dr.

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[736] Leonard Report, ¶ 147.
[737] Leonard Report, ¶ 151.

Leonard's criticism to change my opinion, he would need to demonstrate that the share of malware apps among total apps would increase in the but-for world. He supplies no such analysis

361.   There are good reasons to doubt that malware would enter, swamping gains to consumer welfare with decreases to consumer welfare. If anything, Google would likely have stronger incentives to screen apps for malware in the but-for world. Dr. Leonard does not provide any indication and certainly does not provide any evidence that Google or other app stores would spend fewer resources on app screening or that there would be more malicious apps in the but-for world relative to the actual world.

5.   Dr. Leonard's Criticism of the Normalization of the App Quality Parameter in My Model is Misleading

362.   Dr. Leonard criticizes my normalization that the quality parameter is equal to 1 for all apps as inconsistent with ex-ante symmetry of apps in my model.[738] However, this criticism is redundant and misleading. As I have stated in my Opening Report, my model assumes that all apps have the same expected quality.[739] Here, I formally show that, for the damages purposes, this assumption is equivalent to explicitly introducing heterogeneity in the model and then solving under the assumption of unpredictability.

363.   As I show in Appendix C, introducing marginal cost and app quality heterogeneity is straightforward in my model. I extend my baseline damages model to explicitly allow for such heterogeneity across apps. I solve the model and show that, under unpredictability (or ex-ante symmetry), the equations for quantifying welfare effects are the same as in my baseline damages model in which I set app quality to 1 for all apps. Hence, this shows that Dr. Leonard's claim that assuming app quality of 1 is inconsistent with ex-ante symmetry of apps in my model is misleading.

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[738] Leonard Report, Appendix E, ¶¶ 32-34.
[739] Rysman Opening Report, ¶ 575.

6.   *Dr. Leonard Claims that the Symmetry Assumption with Respect to Entry Cost is False but Does Not Explain the Implications of that Point*

364.   Dr. Leonard claims that the symmetry assumption with respect to entry cost (or developer's fixed cost) is false but does not explain any implications of that assumption and does not provide an alternative quantification of damages.[740]

365.   Dr. Leonard's criticism is flawed for at least two reasons. First, his own cited figures suggest that app development costs can be as low as $10,000 which is below my estimate of fixed cost. Thus, the average fixed cost can well be around my estimate of fixed cost. Second, Dr. Leonard's range is incomplete. Indeed, one of the sources that he cites states that, "[w]ith $22 per hour for creating an app, the cost of building a simple app in India ranges between $4,800 and $11,200. The development of a complex app would cost $12,800 to $22,400, and that of an advanced-level app could cost at least $20,800. While these are the rates for iOS and cross platform apps, Android apps come even cheaper."[741] Hence, Dr. Leonard's claim that the prediction of my model is inconsistent with the facts (*i.e.,* the range of costs of developing an app) is incorrect.

366.   Finally, the assumption of symmetry with respect to the entry costs is an abstraction which, as I have explained above, is a necessary feature of an economic model.

G.   Dr. Leonard's Complaint that I Have Not Identified Apps that Did Not Enter Because of High Commission is Irrelevant

367.   Dr. Leonard criticizes me for not identifying specific apps or developers who did not enter because of Google's high commission; and not providing evidence from developers about the extent to which service fee plays a role in entry decision.[742] In addition, Dr. Leonard purports that "[i]n fact, after the July 2021 Google Play service fee rate reduction, there was no observable spike in either the number or the growth rate of apps that offer paid downloads, IAPs,

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[740] Leonard Report, ¶ 146.

[741] Sebastian, Nathan, "How Much Does It Cost to Develop an App? | GoodFirms Survey," *GoodFirms*, available at: https://www.goodfirms.co/resources/cost-to-develop-an-app.

[742] Leonard Report, § VII.C.1.d.

or subscriptions and incurred sales (based on Google Play's transactions data)."[743] To support his statement, he shows monthly total number of apps and their growth rates over time.[744]

368.   There are a number of problems with Dr. Leonard's arguments and analysis which I explain below.

369.   First, I do not need to show specific apps that did not enter—basic economic theory provides the intuition that entry is linked to expected profits of a firm and that higher expected profits motivate entry.[745] It is a widely accepted economic principle that the more something is taxed, all else equal, the less of it there is.[746]

370.   Second, other Google's experts seem to not contest that profitability of the app store for developers drives entry and investment. For example, Dr. Tucker has section headings titled "Apple and Google compete to Attract Developer's Investments," and "Apple and Google Compete to Enhance Developers' Revenues."[747] ████████████████████████████████

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██████████████████████████[748] It is difficult to think of a more direct way to increase developer revenue than cutting the commission rate, especially under the low pass-through rates proposed by Dr. Leonard. It is contradictory to continually claim that app revenue leads to app entry and

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[743] Leonard Report, ¶ 156 .

[744] Leonard Report, Figures 23 and 24.

[745] Mankiw (2008), at pp. 349-350; Church and Gandal (1993), at pp. 247-249; Dixit and Stiglitz (1977), at p. 300; Nair et al (2004), at pp. 38-39; Berry, Steven T., "Estimation of A Model of Entry in the Airline Industry," *Econometrica*, Vol. 60, No. 4, 1992, pp. 889-917 (hereafter "Berry (1992)"), at p. 892; Bresnahan, Timothy F. and Peter C. Reiss, "Entry and Competition in Concentrated Markets," *Journal of Political Economy*, Vol. 99, No. 5, 1991, pp. 977-1009 (hereafter "Bresnahan and Reiss (1991)"), at p. 982.

[746]Mankiw (2008), pp. 72 and 250; NTRC Tax Research Journal, "Deadweight Loss and Taxation," Vol. 24, No. 6, 2012, at p. 6.

[747] Tucker Report, § IV.C.3 and § IV.C.4.

[748] Tucker Report, ¶ 212 citing to Google, ████████████████████████ February 23, 2016, GOOG-PLAY-000314953.R-981.R, at 960.R.

investment, as Google's experts do, and then question whether reducing the commission rate will lead to app entry and investment.

371.   Finally, Dr. Leonard's analysis of monthly total number of apps over time is flawed and does not represent evidence that there would not have been entry of apps in the competitive but-for world:

- Dr. Leonard emphasizes that, after the July 2021 Google Play commission reduction there was no spike in app entry. However, this is misleading as App development, investment, and R&D decisions and processes usually take time. One would not expect to see an immediate (or short-run) spike in entry after the July 2021 Google Play commission reduction. For example, a source that Dr. Leonard cites suggests that the time required before a soft launch of a game can be in the range from 7 to 16 months. The soft launch itself, during which a game is made available for test launch in a few markets, can last an additional year or even more.[749]

- ██[750] Entry started decreasing in 2022 when life

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[749] Riikola, Atte, "Rovio: Extensive report," Inderes, 2022, at pp. 9-10.
[750] *See* Rysman Rebuttal Report Backup Production.

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started to return to pre-pandemic "normal." Thus, the COVID-19 pandemic can be considered as a temporary positive shock to demand for apps. Thus, in the spirit of Dr. Leonard's arguments, one could interpret the increase in entry as a response to that positive demand shock. ███████████████████████████████████████

████████████████████████████
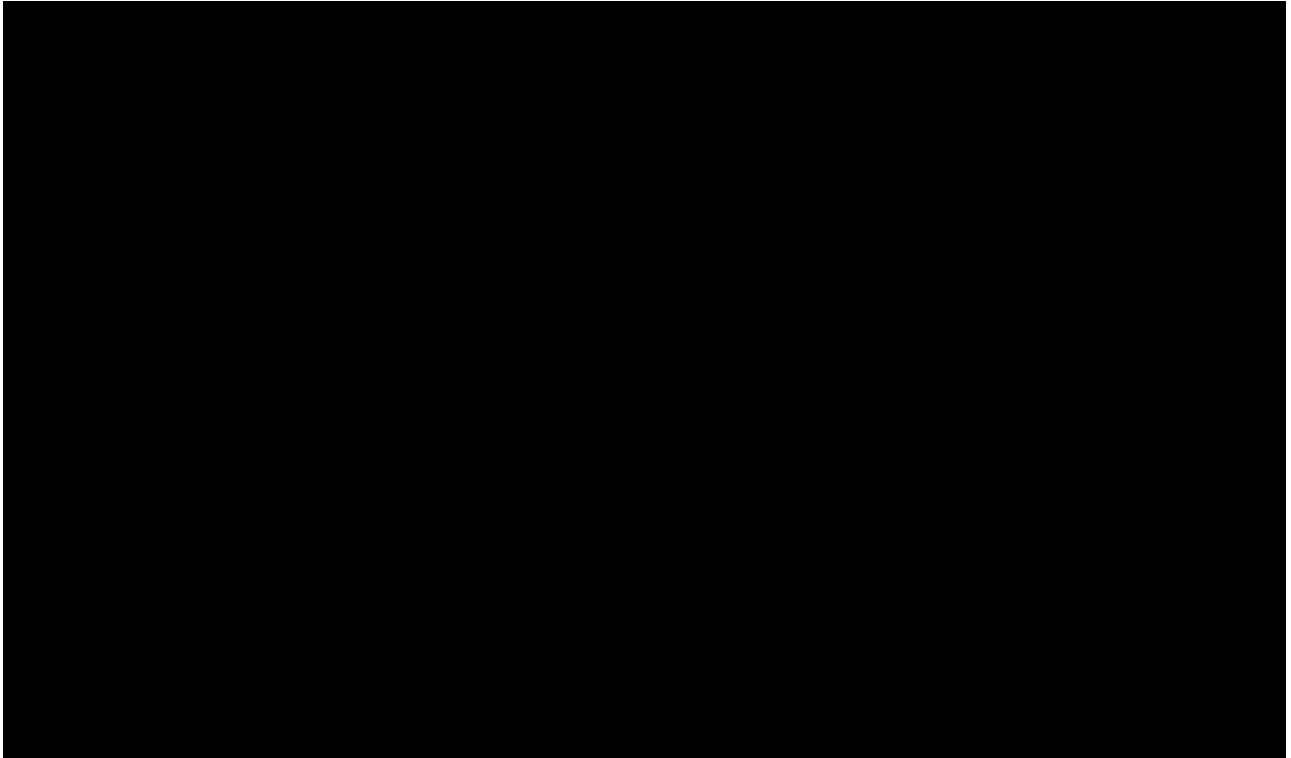
Exhibit 24

Source: Leonard Report Backup Production.

Exhibit 25
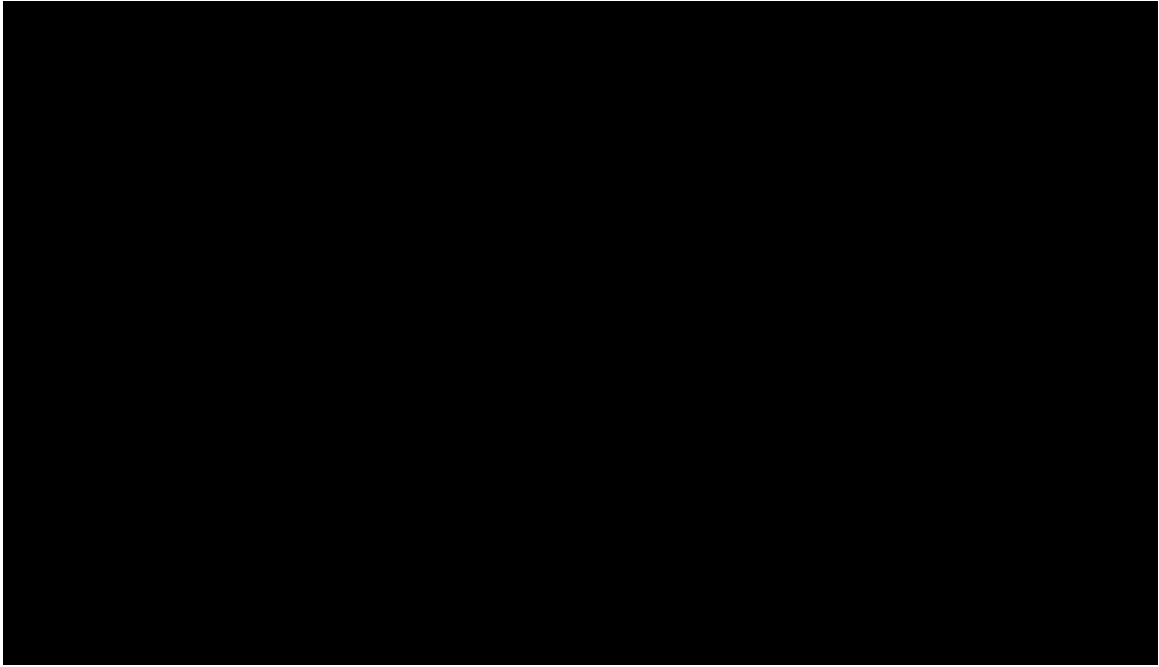
Source: Leonard Report Backup Production.

Exhibit 26
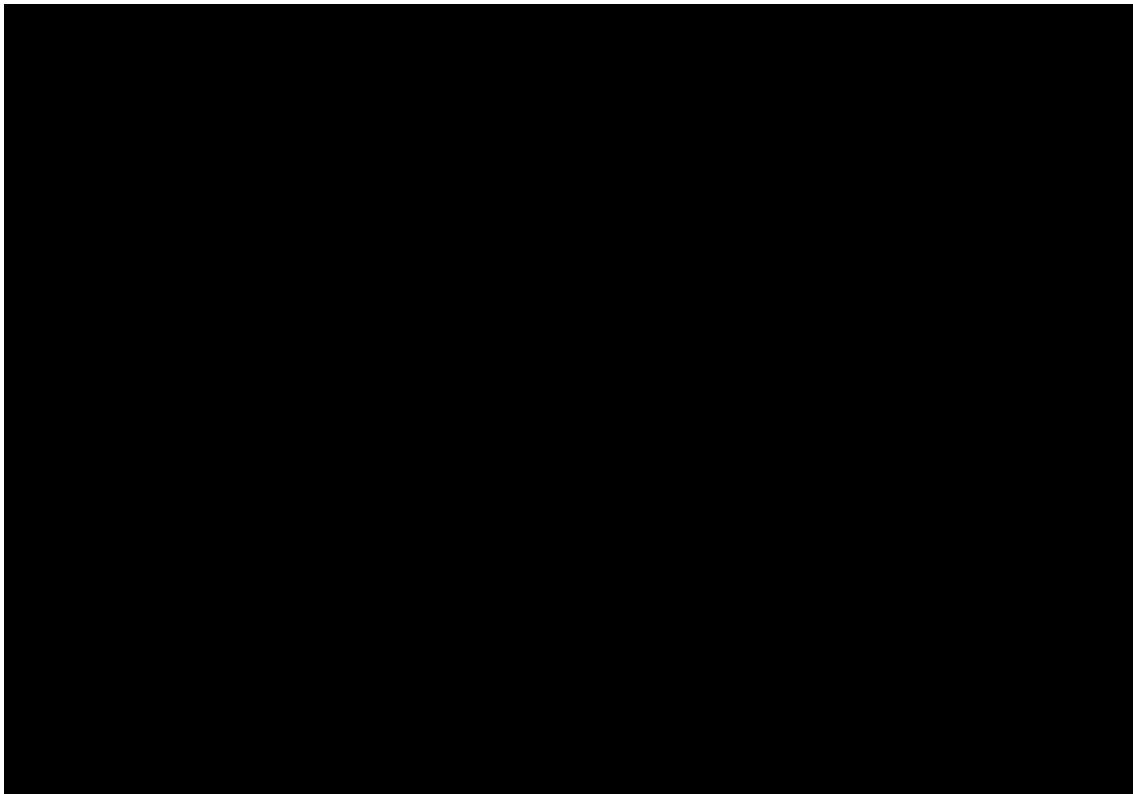
Source: Leonard Report Backup Production.

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H.   Dr. Leonard's Criticisms of the CES Demand Model Fails to Acknowledge My Conservative Assumptions

372.   Dr. Leonard criticizes me for not providing enough support for the demand curve shape that I utilize.[751] He also notes that the CES model has been criticized in the academic literature "because of the restrictions they impose on the substitution patterns between products, a result of the independence of irrelevant alternatives (IIA) property."[752]

1.   CES Demand is a Better Choice to Study the Market in This Matter

373.   Here, I elaborate on the benefits of the CES demand function. First, the CES demand function is a natural choice for this market. The CES demand function represents consumers making continuous choices at many products. By "continuous choice," I mean the consumer chooses how much to purchase of each available product. Consumers can choose to consume more from an app that delivers high utility and less from an app that delivers low utility. That captures consumer activity on the Play Store, where consumers may interact with many apps and at each app, choose how much to use that app, such as how many in-app transactions to make.

374.   The CES model is also attractive because it is very parsimonious. That is, it captures rich interactions with a relatively few parameters, which makes estimation straightforward, and makes transparent what drives my results. In the CES model, the price elasticity and benefit from variety are captured by a single parameter. This is natural because economics recognizes these two phenomena as two sides of the same issue. If two products are highly differentiated, then the two products contribute strongly to the benefit from variety. Similarly, if two products are highly differentiated, then they will not be close substitutes and, even if they are in the same market, they will have relatively inelastic demand. Analogously, if two products are very close substitutes, they will have high price elasticity and also will not offer

[751] Leonard Report, footnote 164.
[752] Leonard Report, ¶¶ 153-154 and footnote 76.

much variety. Thus, a single parameter could capture both the benefits from variety and the price elasticity, and this is elegantly captured by the CES model.

375.   Yet another attractive feature of CES model is that it leads to straightforward estimation equations. As I show in my original report, the CES model generates a regression of the log of quantity on the log of price.[753] In this model, the coefficient on the log of price can be directly interpreted as the elasticity. Such a model can be estimated with simple linear methods, such as ordinary least-squares or two-stage least squares.[754] This is probably the first model that many empirical economists see for how to estimate demand, because estimation is straightforward and interpretation is transparent. It follows naturally from applying the CES model to my data set to use app-fixed effects to control for app quality and time-fixed effects to control for the competitive environment the app faces. In contrast, Dr. Leonard recommends that I use more complex and non-linear estimation methods, such as the Berry, Levinsohn, and Pakes (1995) estimator.[755] These estimators are complex and require careful specification that can lead to debate about the results, as evidenced by the struggles documented in Knittel and Metaxoglou (2014).[756]

376.   Another reason to choose the CES model is that it is very popular in economics. As I have explained above, it is particularly attractive to researchers modeling interactions between many firms in large economies, such as in the literatures of macroeconomics and international trade. Some of the most influential recent papers in these fields are Eaton and Kortum (2002) and Hsieh et al (2009), which both rely on the CES model. I believe this

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[753] Rysman Opening Report, Appendix F.

[754] Rysman Opening Report, ¶¶ 576-577.

[755] Leonard Report, footnote 76. Although Dr. Leonard recommends that I use Berry, Levinsohn, and Pakes (1995) as an estimator, he later states that this model would be inappropriate for app stores as a result of the criticisms in Armstrong, T., "Large market asymptotics for differentiated product demand estimators with economic models of supply," *Econometrica*, 84 (2016), pp. 1961-1980. *See* Leonard Report, Appendix E, footnote 5. Dr. Leonard seems to have contradicted himself here.

[756] Knittel, Christopher R. and Konstantinos Metaxoglou, "ESTIMATION OF RANDOM-COEFFICIENT DEMAND MODELS: TWO EMPIRICISTS' PERSPECTIVE," *The Review of Economics and Statistics*, Vol. 96, No. 1, 2014, pp. 34-59.

literature is natural to draw from given that Google manages a large economy of apps on the Play Store.

377.   Finally, Dr. Leonard criticizes me for not using a nested CES model for damages.[757] He speculates that "adding additional apps to existing nests is likely to be of relatively limited value to consumers." He explains that "[f]or example, consider the weather apps. Adding an additional weather app, once multiple weather apps already existed, is likely to be less important to consumers than adding the first weather app (which would create the weather app nest) to the list of existing nests. "[758]

378.   Dr. Leonard's points in that regard are not substantiated by evidence or mathematical proofs. As I have discussed above, in the economics literature, it is common to use aggregate models with a level of aggregation of products which is at a higher level than I use in this matter. In addition, I have explained how an economic model and its assumptions should be tailored to the questions of interest rather than making a model arbitrarily complex.[759]

379.   Furthermore, Dr. Leonard deems it unlikely that new entry would create new app categories (that is, new nests). However, this claim is unfounded. If lower commissions were to lead to innovation and the creation of categories, welfare benefits could be particularly large in this approach. My approach is conservative in not allowing this to happen.[760]

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[757] Leonard Report, Appendix E, ¶ 28.

[758] Leonard Report, Appendix E, ¶¶ 29-30.

[759] Note that, for example, Janßen et al. (2022) estimated a two-level nested logit demand model using app data on Google Play Store and found no reason to use two-level nested model: "[w]e also estimated a two-level nested logit demand model… with the outside good and each of the app categories as nests… The resulting substitution parameters for the substitution across and within nests were statistically indistinguishable and therefore provided no reason for using a two-level, rather than a one-level, nested logit model." *See* Janßen et al. (2022), p. 28.

[760] Dr. Leonard claims that there would likely be no new app categories from new entry, but he is speculating and provides no support. *See* Leonard Report, Appendix E, ¶ 30.

2. Dr. Leonard's IIA Criticism is Mitigated by Conservative Assumptions That I Impose on My Model and Is Less Relevant to My Analyses

380. Dr. Leonard highlights an issue with the logit model called the independence of irrelevant alternatives (IIA). Dr. Leonard highlights an implication of IIA that the logit model places restrictions on the flexibility of substitution patterns in the data. This can lead to restrictive substitution patterns implied by the model, which can affect the evaluation of substitution between new and existing products.[761] Dr. Leonard cites several papers in this literature. This issue also applies to the CES model that I rely upon.

381. I agree that IIA can be problematic in some applications, but in economics, models must always be tailored to the question the model is meant to answer. Thus, it is important to recognize that the papers that Dr. Leonard cites focus on very different applications than the one I address. In particular, the papers he cites focus on evaluating substitution among a small number of products, which is a common question in the economics subfield of industrial organization.[762] For example, Dr. Leonard cites Nevo (2000) who studies mergers in the ready-to-eat breakfast cereal industry and restricts his sample to cover only 24 brands, with individual firms covering some subset of those.[763] Similarly, Hausman (1996) studies the introduction of a single new product, Apple-Cinnamon Cheerios, into the cereal market.[764] Brownstone and Train (1999) consider the choice among six hypothetical vehicle types with different characteristics (in particular, fuel types).[765] If I were asked to evaluate interactions among a small number of products, for instance a merger between two developers that create games for Android, I might

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[761] Leonard Report, ¶¶ 153-154 and footnote 76.

[762] Leonard Report, footnote 76.

[763] Nevo, Aviv, "Mergers with Differentiated Products: The Case of the Ready-to-Eat Cereal Industry," *RAND Journal of Economics*, Vol. 31, No. 3, 2000, pp. 395-421, at pp. 404-408.

[764] Hausman, Jerry A., "Valuation of New Goods under Perfect and Imperfect Competition," in *The Economics of New Goods*, Vol. 58, Studies in Income and Wealth, Eds. Timothy F. Bresnahan and Robert J. Gordon, Cambridge, MA: National Bureau of Economic Research, 1996, pp. 209-247, at p. 210.

[765] Brownstone, David and Kenneth Train, "Forecasting new product penetration with flexible substitution patterns," *Journal of Econometrics*, Vol. 89, 1999, pp. 109-129, at p. 116.

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choose a different model that would allow me to better capture substitution patterns between the individual products at issue and their closest rivals.

382.   However, the question at hand in this case is very different. I am studying Google's operation of a platform with literally millions of apps, with apps entering and exiting over multiple years. These characteristics are more characteristic of macroeconomics and international trade than merger-focused analysis. Dr. Leonard claims that the systems based on Berry, Levinsohn, and Pakes (1995) "are the most commonly used in empirical economics research today."[766] I disagree with this statement. These systems are commonly used in industrial organization, and those are the examples he cites, but these systems are applied only sporadically in other subfields of economics. The level of detail in this kind of analysis is often inappropriate for questions about interactions among a very large numbers of firms, such as on the Google Play Store.

383.   As I mention above, better models for studying the Google Play Store are models in spirit of Eaton and Kortum (2022) and Hsieh et al (2009), which study trade and macroeconomics. Such papers model interactions across many firms and the resulting economic phenomena. These papers do not attempt to model heterogeneous substitution patterns among millions of firms, but rather use a CES model with a single substitution parameter to address industries much broader than the one I address. Dr. Leonard provides no empirical evaluation of whether abstracting away from heterogenous substitution patterns does or does not create issues. Dr. Leonard also does not address that this kind of abstraction is widely considered to be acceptable in important empirical papers that are similar to the Google Play Store question in important ways.

384.   One implication of IIA is that it is possible for such models to overstate welfare gains from new products. I have co-authored a paper – Ackerberg and Rysman (2005) – directly

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[766] Leonard Report, footnote 76.

on this topic, and I brought those concerns to this analysis.[767] Intuitively, an interpretation and example of the potential issue is that new products could crowd out existing products in a retail store or a shelf space, and if this is an issue, then we show in the paper how to account for this.[768] It is important to recognize that whether this issue is material is an empirical question. It is not guaranteed to be a problem, and some papers show that the issue is not important in their analysis.[769] In my original report, I address this issue in two ways. Ackerberg and Rysman (2005) is written mostly in terms of the logit model rather than the CES model, but we can still apply the paper's recommendations. First, Ackerberg and Rysman (2005) recommend controlling for the number of products in the market in estimation.[770] This would mean controlling for the number of apps on the Google Play Store in a given month. However, I use month-fixed effects, which naturally controls for the number of apps in a month. Thus, the main estimation recommendation from Ackerberg and Rysman (2005) is already accounted for.

385.   Second, I have made conservative assumptions regarding elasticities. The problem might arise in the calculation of damages.[771] When we compute the quantity expansion from reducing Google's commission to the but-for rate, the issue of crowding implies that we might overstate the quantity increase and thus overstate the welfare gain. I insulate myself from this criticism by using a very conservative market wide elasticity, which reduces the quantity increase that results from reducing the commission rate. In particular, I use an elasticity of one,

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[767] Ackerberg, D. A. and Rysman, M., "Unobservable product differentiation in discrete choice models: Estimating price elasticities and welfare effects," *RAND Journal of Economics*, Vol. 36, No. 4, 2005, pp. 771-788 (hereafter "Ackerberg and Rysman (2005)").

[768] Ackerberg and Rysman (2005), p. 773.

[769] For example, Gowrisankaran and Rysman (2012) test for crowding in the spirit of Ackerberg and Rysman (2005) and find that the issue is not important: "[f]inding a coefficient of zero implies that the logit model is well specified, whereas a coefficient of -1 implies 'full crowding,' so there is no demand expansion effect from variety." *See* Gowrisankaran, Gautam, and Marc Rysman, "Dynamics of Consumer Demand for New Durable Goods," *Journal of Political Economy*, Vol. 120, No. 6, 2012, pp. 1173-1219, at p. 1197.

[770] Ackerberg and Rysman (2005), p. 773.

[771] Not addressing crowding in the SSNIP is actually conservative. As the hypothetical monopolist imposes a higher commission, app prices increase, which leads to a reduction in the quantity transacted and a reduction in the number of apps on the market. If crowding were a concern, less apps would mean less crowding, which would increase the quantity transacted relative to the no-crowding benchmark, which makes the hypothetical monopolist more profitable.

which is more inelastic than what I find for the market-wide elasticity in my original report. My results are conservative even if crowding is present, as long as the level of crowding is not so great as to reduce the elasticity below one. Overall, the concerns in Ackerberg and Rysman (2005) appear to be unimportant for my model.

3. Dr. Leonard's criticism of Ghose and Han (2014) Elasticity Estimate is Redundant

386.   Dr. Leonard criticizes the own-price elasticity of demand estimate that I use from the Ghose and Han (2014) paper.[772] However, he fails to recognize that I have used that elasticity to be conservative as it represents *an* upper bound on my elasticity estimate based on my regression work. I could have used my elasticity estimate which would be less conservative.

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██[773] Dr. Leonard suggests using an adjusted Ghose and Han (2014) elasticity.[774] However, I do not see a reason for making the elasticity estimate even more conservative given the results of my regression work.[775]

387.   In any case, Dr. Leonard's criticism of Ghose and Han (2014) and its applicability to this matter is flawed. For example, Dr. Leonard claims that I overestimate elasticity by using the Ghose and Han (2014) elasticity: "Dr. Rysman's extrapolation of the elasticity for the top 400 paid apps to all paid apps is flawed."[776] His calculations are incorrect. First, he makes a misleading claim that "in the context of Dr. Rysman's model where apps all have the same quality, the top 400 apps could have higher share only by having a lower price."[777] As I have explained elsewhere, the homogenous quality assumption in my damages model is an abstraction and, as I have explained, Dr. Leonard's interpretation of the assumption is too literal. Indeed, in

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[772] Leonard Report, Appendix E, ¶¶ 4-7.

[773] *See* Rysman Rebuttal Report Backup Production.

[774] Leonard Report, Appendix E, ¶ 6.

[775] Although, for the sake of comparison, I also run my damages model using Dr. Leonard's proposed elasticity estimate. *See* Rysman Rebuttal Report Backup Production.

[776] Leonard Report, Appendix E, ¶ 5-6.

[777] Leonard Report, Appendix E, ¶ 6.

my regressions I explicitly use heterogeneity across the apps by controlling for app quality and other fixed effects. Hence, my demand model and my elasticity estimate are consistent with and account for ex-post heterogeneity. Thus, Dr. Leonard's calculations based on the premise that the top 400 apps could have higher share only by having a lower price is wrong because the premise itself is wrong.

388.   Finally, Dr. Leonard questions the validity of the instruments used by Ghose and Han (2014) based on the arguments in Armstrong (2016).[778] However, Armstrong's criticism is unlikely to apply. Armstrong is concerned with a largely theoretical point that as the number of products in a market goes to infinity (that is, the "Large Market Asymptotics" in the title), price-cost margins ("markup") tend to a constant term, and then, instruments based on shifters of the price-cost margin no longer apply.[779] However, Ghose and Han study a market with 400 paid apps. 400 is a lot less than infinity.[780] Moreover, there is no claim that all apps on the Play Store have the same margins. Personally, I view Armstrong's criticism as a largely theoretical point about asymptotics (*i.e.,* pertaining to situations in which the number of products goes to infinity) rather than a criticism of any applied work.

I.   Dr. Leonard Asserts That There Would Be Increased Costs to Developers and Consumers in the But-For World and Provides Two Theoretical Models That Do Not Fit the Facts of the Case

389.   Dr. Leonard asserts that consumers and developers would face higher costs in the but-for world. For consumers, these costs might have been (1) higher search costs to find apps;

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[778] Leonard Report, Appendix E, footnote 5.

[779] Armstrong, Timothy B., "LARGE MARKET ASYMPTOTICS FOR DIFFERENTIATED PRODUCT DEMAND ESTIMATORS WITH ECONOMIC MODELS OF SUPPLY," *Econometrica*, Vol. 84, No. 5, 2016, pp. 1961-1980, at pp. 1961 and 1969.

[780] This is still the case even with the additional 400 free apps. *See* Ghose and Han (2014), p. 1471. Armstrong also conducts Monte Carlo Simulations where he shows that the number of "markets" (*e.g.,* number of geography x time periods in the data) is also important to determine how well BLP instruments perform. When the number of markets is large enough relative to the number of products, the instruments perform better. For example, in one of his simulations, he considers 20 markets and 100 products per market. *See* Armstrong (2016), pp. 1976-1977. In Ghose and Han (2014), there are about 120 "markets" as they use daily data over four months. *See* Ghose and Han (2014), p. 1473.

(2) for apps that exhibit direct network effects (value of an app increasing with number of other consumers using the app), in the but-for world, the number of consumers consuming each such app could have been lower and hence each consumer would get less value from consuming such apps. For developers, these might have been costs associated with multi-homing related to separate app store applications, negotiations, and others.[781]

390.   Dr. Leonard's main support for his claims with regard to higher costs to consumers in the but-for world are two theoretical models that he offers in Appendix E of his report. These models generate different welfare results than the model I propose. Dr. Leonard provides no reason to think his models better fit the data or facts of the case than my model, and he provides no empirical validation of his models. I discuss below how his models match the case poorly, particularly in regard to the main issues his models are meant to address. His main goal does not seem to be to develop realistic models but rather to show that different models than the one I propose would generate different results. However, there is no dispute on the point that alternative models that do not fit the facts at hand would find different results. Accepting this point does not undercut my results and, to the contrary, strengthens my confidence in my results.

391.   In what follows, I explain why Dr. Leonard's models and criticisms are speculative and contrary to the facts of the case.

> 1.   *Dr. Leonard's Direct Network Effects Model is Arbitrary and Its Implications Are Not Supported by Facts of This Case*

392.   Dr. Leonard asserts that for "many" apps "the value of the app to a consumer increases with the number of other consumers that use the app."[782] He claims that such apps could have been less valuable to consumers in the but-for world because fewer people could be consuming each such app in the but-for world. He provides a model to illustrate his point.[783]

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[781] Leonard Report, ¶¶ 158-161.
[782] Leonard Report, ¶ 160.
[783] Leonard Report, ¶ 160 and Appendix E, § IV.

393.   Dr. Leonard does not provide any evidence to support his claims, nor does he provide any support for his model from the literature. Certainly, he does not provide an estimate of the parameter that he introduces in his model with direct network effects. In this sense, his model is just a theoretical comparative static.

394.   He adjusts my model to account for within-app network effects. In his model, the utility that any consumer obtains from an app goes up in the quantity of purchases made by other consumers of that app. As the variety of apps increases, the quantity of purchases at each app can decrease, which dissipates network effects. In addition, Dr. Leonard argues that one would need to compensate less to consumers because "a given increase in budget in the actual world would have led to more expenditure on the apps that existed in the actual world and thus more usage of those apps. This increase in usage would, through the direct network effects, increase the quality of the apps that existed in the actual world, and the higher app quality would have benefited consumers."[784]

395.   There are numerous criticisms one could make of his approach. For instance, most models of network effects distinguish between a stand-alone effect of the product and the network effect.[785] The stand-alone value is the value if no one else used the app. In a game, it would be the value of playing against the computer. The network effect captures the value when other people use the game. In Dr. Leonard's model, there is only the network effect and no standalone effect, which is unrealistic.[786] Also, his approach relies heavily on the quantity of transactions being the same across all apps. As discussed in my report, I use that as an abstraction that allows me to focus on the main issues of the case, and it obviously is not meant to be an important prediction of the model. By emphasizing this point, he is taking my model out

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[784] Leonard Report, Appendix E, ¶ 22.

[785] *See* for example, Katz, Michael L. and Carl Shapiro, "Network Externalities, Competition, and Compatibility," *The American Economic Review*, Vol. 75, No. 3, 1985, pp. 424-440, at p. 426.

[786] There may exist apps where almost all of the value comes when other people use it, such as for communication apps like Facebook, Snapchat, and Whatsapp. However, these apps are often completely free, and thus, less important for my analysis, which emphasizes apps subject to Google's commission. In contrast, games and other apps typically have an important stand-alone benefit.

of context and using it in unintended ways. In the but-for world, I expect consumers to gravitate to the best apps, and having more variety gives consumers more opportunities to realize better apps. The fact that I do not provide an explicit model of this process simplifies my analysis but is still captured by my variety model in the sense that the utility of Android goes up in the number of unique apps even when I conservatively assume that spending does not go up in the but-for world.

396.   But by far, the biggest problem with Dr. Leonard's network effect model is that there is no evidence that the effect he describes actually matters. If the mechanism that Dr. Leonard presents was important, Google would want less variety rather than more variety of apps in order to concentrate consumer usage on a few apps, have the apps realize higher levels of network effects, enhance consumer welfare, and then to presumably extract more revenue. ████

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████████████[787] Even if the within-app network that Dr. Leonard proposes were of only moderate importance, Google would still have an incentive to reduce the variety of apps from the free entry equilibrium, but I am not aware of a claim that Google engages in this behavior at all or ever even considers this issue. Apple and Google engage in some curation of the apps on their stores, but even in this case, it is more about filtering out low-quality apps.[788] I am not aware of Apple or Google restricting entry in order to concentrate usage on fewer apps to take advantage of within-app network effects. It is unclear why Dr. Leonard proposes this as a useful model, and in fact, he never claims that the model fits the facts of the case better than my model, and it clearly does not.

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[787] Chu (Google) Deposition, at pp. 94-95.

[788] Condon, Stephanie, "Tim Cook: Without Apple curation, App Store would be a 'toxic mess," *ZDNET*, May 21, 2021, available at https://www.zdnet.com/article/tim-cook-without-apple-curation-app-store-would-be-a-toxic-mess/ and Geeksforgeeks, "Google Play Protect: How it Detects and Removes Malicious Apps?" June 7, 2019, available at https://www.geeksforgeeks.org/google-play-protect-how-it-detects-and-removes-malicious-apps/.

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2.   *Dr. Leonard's Search Cost Model is Not Supported by Facts of This Case*

397.   Dr. Leonard claims that search costs for consumers would increase in the but-for world which would be an offset to damages. The reason is that "one would expect that consumers would have had to spend more time searching to identify the set of apps to download to their phones."[789] He provides a model to illustrate his point,[790] based on Anderson and Renault (1999).[791] In this model, consumers search for a product from a given number of products. They search sequentially and in a fixed order of products.[792] Dr. Leonard claims that "the variety effect in this model would be negligible as long as the large majority of consumers reach their optimal stopping point on app search short of n in the actual world. For such a consumer, increasing n in the but-for world would have no effect on their welfare (holding app prices constant); that is, there is no significant 'variety' effect in this model."[793] Dr. Leonard does not provide any empirics about how many apps consumers search across when choosing an app, but suppose the number is 100, which I think is a conservatively high choice. In Dr. Leonard's model then, consumers put no value on the number of apps in an operating system beyond 100. That runs counter to evidence in this case. The Google Play Store had over three million apps, and the Amazon Store, which Google deemed too small to compete with the Play Store, still had about half a million apps.[794] Google's experts and I agree that variety is a value-add for app stores.[795] Dr. Leonard offers no explanation or support for why his model might be a reasonable description of the case at hand, and seems clear that it is not. Dr. Leonard also does not provide

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[789] Leonard Report, ¶ 159.

[790] Leonard Report, Appendix E, ¶¶ 15-20.

[791] Anderson, Simon P. and Regis Renault, "Pricing, product diversity, and search costs: A Bertrand-Chamberlin-Diamond model," *RAND Journal of Economics*, Vol. 30, No. 4, 1999, pp. 719-735 (hereafter "Anderson and Renault (1995)").

[792] Anderson and Renault (1995), pp. 721-723.

[793] Leonard Report, Appendix E, ¶ 20.

[794] FinancesOnline, "Number of Apps in Leading App Stores in 2022/2023: Demographics, Facts, and Predictions," November 6, 2022, available at https://financesonline.com/number-of-apps-in-leading-app-stores/.

[795] *See, e.g.,* Tucker Report ¶¶ 214-16.

an estimate of the parameter that he introduces in his model. In this sense, his discussion is just a theoretical comparative static.

398.   Consumers do not search blindly, as is the case in Dr. Leonard's model. The Google Play Store provides discoverability features, and this helps consumers to find more relevant apps when more apps are available.[796] In addition, apps also have effective ways to reach consumers. Indeed, one source that Dr. Leonard cites states that "[1] [t]he empirical results show that consumers prefer more diversified apps when they are making download decisions… which is supported by the psychology literature on people's variety seeking behavior… [2] developers are actively exploring various user acquisition channels, including mobile display ads… purchased downloads… price promotions… and search ads… [3] CP [cross-promotion] has been successfully implemented in the industry."[797]

399.   Indeed, Dr. Tucker has opined that "[t]he Google Play store creates value for the Android ecosystem by reducing search costs for users and developers to find one another… [t]o do so, Google helps developers increase their apps' 'discoverability' by interested users… Google also supports users' ability to find the apps that most closely match users' needs—for example, by improving algorithms to create personalized recommendations and continually

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[796] Google, "Get Discovered on Google Play Search," available at https://support.google.com/googleplay/android-developer/answer/4448378?hl=en and Google, "How Google Play Works," available at https://play.google.com/about/howplayworks/ (noting that "Google Play makes it easy to discover high-quality apps and games…Ensuring a positive experience when navigating Google Play means making it easy to find the apps our users know and love as well as new and undiscovered titles. The Play Store gives users a variety of ways to discover the right apps, like browsing our most popular apps, searching for a specific title, or viewing recommendations.").

[797] Lee, Gene Moo, Shu He, Joowon Lee, and Andrew B. Whinston, "Matching Mobile Applications for Cross-Promotion," *Information Systems Research*, Vol. 31, No. 3, 2020, pp. 865-891, at pp. 865-866; Tapjoy website describes it as follows: "[a]dvertisers place ads with Tapjoy, and Tapjoy shows those ad offers to you, the user, in advertising space in participating publishers' apps. When you complete the ad offer, the advertiser notifies Tapjoy so we can reward you. Tapjoy rewarded advertising allows users like you to be rewarded for their time and attention, publishers to earn money through their apps, and advertisers to reach users who may be interested in their products and services." *See* Tapjoy, "What Is Tapjoy?" available at https://www.tapjoy.com/faqs/what-is-tapjoy/#:~:text=Advertisers%20place%20ads%20with%20Tapjoy,so%20we%20can%20reward%20you.

improving store design to allow for improved navigation."[798] It is not clear why Dr. Leonard claims that the search costs are important and would increase in the but-for world. Indeed, if anything, one would think that Google and other market participants (*e.g.,* developers) would have even stronger incentives to improved discoverability in the but-for world.

3. Dr. Leonard Purports Increased Costs to Developers in The But-For World Without Providing Any Evidence

400.   Dr. Leonard claims that "[d]evelopers who would have multi-homed in the but-for world would have incurred additional costs related to separate app store applications, negotiations, different compliance requirements, different versions of Android systems (especially if that means different programming languages or substantively different versions of the same programming languages need to be used), among others."[799]

401.

[800] In addition, in Section V.G above, I show why Dr. Gentzkow's claim that Google's challenged conduct resolves fragmentation fails to recognize important evidence in the case.

J.   Dr. Leonard's Criticisms Do Not Alter My Damages Assessment

402.   Dr. Leonard's criticisms do not alter my damages assessment. His criticisms are based on arguments that are generally unfounded and based on either flawed or equivocal intuition. In addition, his models are not based on the facts of this case.

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[798] Tucker Report, ¶ 106; she also cites an email from Ankit Jain to Play Recommendations et al., June 28, 2012, GOOG-PLAY-002863312-313

[799] Leonard Report, ¶ 161.
[800] Rysman Opening Report, ¶ 521.

403.   Dr. Leonard misrepresents my benchmarking method for but-for commission and repeatedly states that, in my model, I have assumed a 100% pass-through rate, which is incorrect. His own damages quantifications completely ignore any effect of Google's anticompetitive conduct on consumers through variety and he does not even attempt to propose a "corrected" version of my variety damages quantification.

404.   Dr. Leonard also criticizes my damages model claiming that it is stylized and based on unrealistic assumptions. His criticism mostly stems from speculation and equivocal intuition and misses the fundamental point that economic models set aside immaterial details and focus on the most important aspects that pertain to a given question under consideration. He also does not acknowledge the many conservative assumptions that I impose. Finally, Dr. Leonard's baseless criticism that my damages model does not account for consumer search costs and direct network effects is without merits and does not fit the facts of this case.

405.   As I have explained in my Opening Report, to assess the harm to consumers caused by Google's anticompetitive and exclusionary conduct, I developed a model of monopolistic competition between apps, based on Church and Gandal (1993), in which developers supply apps and in-app content and compete on prices charged to consumers. I used the model to calculate the effects that a lower commission and more Play Points would have had, but for Google's anticompetitive conduct, on consumers' welfare, including a direct effect, a welfare effect through increased varieties/apps, as well as a combined total effect.

406.   I provided several measures of welfare effects that variously hold entry constant, hold prices constant, or allow for a total effect on consumer welfare in response to Google's high commissions and low discounts. While the total welfare effect accounts for all of the economic effects of the high commissions and low discounts, to be conservative I took the minimum of the total welfare effects and variety effects, where, in the latter, I hold the price constant, (i.e., no changes in app pricing in response to commission changes), to arrive at my proposed damages. █

VII.   Conclusion

407.   Based on my review of the reports Google submitted, my analyses presented in this report and those summarized in my Opening Report, my review of the record, and my experience as an industrial organization economist, it remains my opinion that Google has engaged in anticompetitive conduct that caused harm to competition and harmed Android smart mobile device users in the U.S. and worldwide (excluding China).
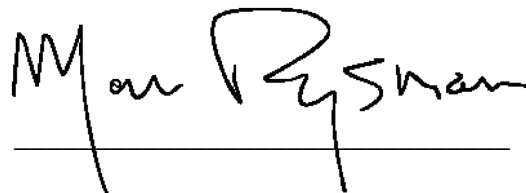
408.   I find the opinions of Google's consultants flawed and unconvincing. Dr. Tucker errs in focusing on the entire Android ecosystem, which leads her to define an overly broad and vague relevant product market consisting of "facilitation of digital transactions" and mistakenly conclude that Google does not have market power. She mistakes limited substitution away from Android smart mobile devices to other platforms in the actual world, in which Google has exercised its market power, as evidence of substitution in a counterfactual world. In failing to compare Google's actual world commission, output, and innovation with an appropriate competitive benchmark, her claims regarding Google's commission, output, and innovation are uninformative.

409.   Dr. Gentzkow's analysis of Google's conduct relies on standards that would likely find very little conduct anticompetitive. He mistakenly considers each part of Google's challenged conduct (and each type of contract) separately, failing to recognize the collective impact of Google's conduct and ignoring that Google itself considered the collective impact of the various elements of its challenged conduct. His claim that the "availability" of alternative app distribution channels is sufficient to find there is no harm to competition is not grounded in antitrust principles and ignores the extent to which these channels, even when available, were disadvantaged by Google's conduct. His five-factor test to demonstrate that Google's "price" is "effective" appears designed to fit the facts of Google's conduct and conflates "effective" with "competitive," and Dr. Gentzkow fails to recognize that monopolists could satisfy certain of his factors.

410.   Dr. Leonard misunderstands and/or mischaracterizes my damages model. He misrepresents my benchmarking methodology for the but-for commission of 15%, incorrectly claims my model assumes 100% pass-through, and mistakenly contends my model fails to

account for heterogeneity across apps and uses simplifying assumptions for the sake of analytical tractability. Moreover, Dr. Leonard's proposed adjustments to my model do not fit the facts of this case.

411.   Finally, while Google's consultants may criticize details of how I implemented my analyses, there is no dispute about the basic idea that, in general, economics provides valid methods and tools for my calculations. Therefore, I continue to find that Google (i) holds market power in two relevant antitrust markets, each of which is pertinent to evaluating the effects of Google's challenged conduct, (ii) engaged in a combined course of anticompetitive conduct through which it restricted competition by imposing barriers in each Android app distribution channel and maintained market power in the market for Android App Distribution, (iii) tied the use of Google Play Billing to its app distribution services, and, through this collective challenged conduct, (iv) caused harm to competition and consumers.

Marc Rysman, Ph.D.

December 23, 2022

Appendix A
Curriculum Vitae of Marc Rysman

MARC RYSMAN
Department of Economics
Boston University
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Boston, MA 02215

mrysman@bu.edu
sites.bu.edu/mrysman/
(617) 353-3086 (office)

EDUCATION

Ph.D.   Economics, University of Wisconsin-Madison

B.A.   Economics, Columbia University

PRIMARY ACADEMIC APPOINTMENTS

Professor, Boston University, 2011 to present

Associate Professor, Boston University, 2006 to 2011

Assistant Professor, Boston University, 1999 to 2006

VISITING POSITIONS

Visiting Scholar, Center for Consumer Payments Research, Federal Reserve Bank of Boston, 2009-2019

Visiting Scholar in Economics, Harvard University, 2014-2015

Visiting Associate Professor, Economics Department, Massachusetts Institute of Technology, 2007-2008

Visiting Scholar in Economics, Harvard University, 2003-2004

Visiting Fellow, Center for Studies in Industrial Organization, Northwestern University, May-June 2003

Visiting Scholar, Federal Reserve Bank of Minneapolis, July 2003

Research Assistant, Brookings Institution, 1992-1994

EDITORIAL POSITIONS

Editor, RAND Journal of Economics, 2014-2020

Editor, Review of Network Economics, 2010-2015

Associate Editor, Journal of Industrial Economics, 2010-2014

Associate Editor, The RAND Journal of Economics, 2007-2014

Associate Editor, International Journal of Industrial Organization, 2005-2014

Co-editor, Journal of Economics and Management Strategy, 2007-2010

OTHER PROFESSIONAL SERVICE

Advisory Committee on Interoperable Payment Systems Project for Innovations for Poverty Action, 2022

Program Committee for Asia-Pacific Industrial Organization Conference, December 2021

Scientific Committee for Online Seminar on the Economics of Platforms, Toulouse School of Economics, 2020 to present

Faculty affiliate to the Rafik B. Hariri Institute for Computing and Computational Science & Engineering, Boston University

Faculty affiliate to the Center for Innovation in Social Sciences, Boston University

Sponsorships, Industrial Organization Society, 2022

Secretary, Industrial Organization Society, 2018 to present

President, Industrial Organization Society, 2016-2017

Vice-President, President-Elect of Industrial Organization Society, 2014-2015

Academic Panel Member, Competition and Markets Authority, United Kingdom, 2016-2020

Organizing Committee, International Industrial Organization Conference 2008-2014

Organizer, Standards, Innovation and Patents Conference in Tucson. Sponsored by the NBER and USPTO. February 2012. Editor for special issue in IJIO

Organizing Committee, European Association for Research in Industrial Economics (EARIE) conference, Stockholm, 2011

Local Organizer, Summer Meetings of the North American Econometric Society, Boston University, 2009

UNIVERSITY SERVICE

Chair of the Department of Economics, 2020- present

Associate Chair of the Department of Economics, 2017-2020

Department Liaison to the Scientific Computing and Visualization Center, 2012- 2016

Merit and Equity Advisory Committee, 2001, 2002, 2009, 2014, 2016, 2019

Advisor to Second-year Graduate Students, 2013-2014, 2008-2009

Director, Junior Recruiting Committee, 2006-2007, 2009-2010, 2013-2014

Department newsletter, 2013

Chair, Academic Promotion and Tenure, College of Arts and Sciences, 2012-2013

Academic Promotion and Tenure, College of Arts and Sciences, 2011-2012

Discussion Facilitator in the Program in Responsible Conduct of Research for Graduate Students and Postdoctoral Researchers on March 31, 2011

College Teaching Prize Committee, Spring, 2011

Committee on Conflicts of Interest, 2008-2011

Co-director, Junior Recruiting Committee 2000-2001

Social Science Curriculum Committee, 2005-2007

Representative to CAS Reg-Prep (Registration Preparation)

Acting Director, Industry Studies Program, 2001-2002, 2009-2010

Summer Orientation Academic Advising, 2001, 2002, 2004, 2005

Junior Recruiting Committee 1999-2005

Undergraduate Studies Committee 1999-2005

INVITED LECTURES (SELECTED)

"Empirics of Network Effects," Plenary Talk, Conference on "Digital Platforms: Opportunities and Challenges," Toulouse School of Economics, October, 2020.

Panel on "The Current Economic Understanding of Multi-Sided Platforms," Competition and Consumer Protection Hearings, organized by the Federal Trade Commission at George Mason Law School, October, 2018.

"Antitrust in Digital Industries," Public Lecture organized by the Japanese Federal Trade Commission, Tokyo, March, 2014.

"Estimating Price-Cost Margins in a Dynamic Environment," Invited Lecture, European Association for Research in Industrial Economics (EARIE), Munich, September 2015.

"Payment Networks," Academic Consultants Conference for the members of the Board of Governors, Federal Reserve Bank, October 2011.

"Estimating Network Effects in a Dynamic Environment," Invited Lecture, European Association for Research in Industrial Economics (EARIE), Stockholm, September 2011.

"Adoption and Use of Payment Instruments by US Consumers," Keynote speech at conference entitled Payments Markets: Theory, Evidence and Policy, Granada, Spain. June, 2010.

"Platform Pricing at Sportscard Conventions," Plenary speech at conference entitled Platform Markets: Regulation and Competition Policy. Mannheim, Germany, May, 2010.

"Empirical Analysis of Payment Card Usage," Plenary session at Conference on Two-Sided Markets, Institut D'Economie Industrielle, Toulouse, January 2004.

INVITED SHORT COURSES

"Two-Sided Markets: From Theory to Empirics and Applications," Shanghai University of Finance and Economics, June 2017.

"Static and Dynamic Demand Estimation," for joint PhD program among Berlin universities, August 2014.

"Network Effects, Two-Sided Markets and Standard Setting," Fordham Competition Law Institute Training for Agency Economists. (I taught one section of a week-long training for competition authority economists from many countries.) June, 2007-June, 2013.

"Structural Econometrics in Industrial Organization," Hitotsubashi University, February 2009.

PUBLICATIONS

Leong, K., Li, H., Rysman, M., and Walsh, C. (2022). Law enforcement and bargaining over illicit drug prices: Structural evidence from a gang's ledger. *Journal of the European Economic Association*, 20:1198–1230.

Rysman, M. and Schwabe, R. (2021). Platform competition and the regulation of stock exchange fees. *Concurrences Competition Law Review*, (4):27–33.

Jullien, B., Pavan, A., and Rysman, M. (2021). Two-sided markets, pricing, and network effects. In Ho, K., Hortacsu, A., and Lizzeri, A., editors, *Handbook of Industrial Organization*, volume 4, chapter 7, pages 485–592. Elsevier.

Celiktemur, C., Klein, A., Rysman, M., and Mani, V. (2021). Taming gatekeepers - but which ones? *Competition Policy International*.

Rysman, M., Simcoe, T., and Wang, Y. (2020). Differentiation in adoption of environmental standards: LEED from 2000-2010. *Management Science*, 66:4173–4192.

Chiou, L., Kafali, E. N., and Rysman, M. (2020). Internet use, competition, and geographical rescoping in Yellow Pages advertising. *Information Economics and Policy*, 52. Article 100867.

Chu, C. S. and Rysman, M. (2019). Competition and strategic incentives in the market for credit ratings: Empirics of the financial crisis of 2007. *American Economic Review*, 109:3514–3555.

Rysman, M. (2019). The reflection problem in network effect estimation. *Journal of Economics and Management Strategy*, 28:153–158. Named *Management Science* Top 10 most downloaded paper over two years.

Greene, C., Rysman, M., Schuh, S., and Shy, O. (2018). Costs and benefits of building faster payment systems: The U.K. experience. *Journal of Financial Transformation*, 47:51–66.

Rysman, M. and Schuh, S. (2017). New innovations in payments. In Greenstein, S., Lerner, J., and Stern, S., editors, *Innovation Policy and the Economy*, volume 17, pages 27–48. University of Chicago Press.

Falls, C., Friedman, P., and Rysman, M. (2016). The impact of the internet on distribution. In Banks, T., Langenfeld, J., and Wittrock, Q., editors, *Antitrust Law and Economics of Product Distribution*, chapter 10, pages 475–495. American Bar Association, second edition.

Rysman, M. (2016). Empirics of business data services. Appendix B of *Business Data Services Federal Notice of Proposed Rulemaking*, FCC 16-54.

Koulayev, S., Rysman, M., Schuh, S., and Stavins, J. (2016). Explaining adoption and use of payment instruments by US consumers. *RAND Journal of Economics*, 47:293–325.

Jin, G. and Rysman, M. (2015). Platform pricing at sports cards conventions. *Journal of Industrial Economics*, 63:704–735.

Rysman, M. and Wright, J. (2014). The economics of payment cards. *Review of Network Economics*, 13:303–353.

Rysman, M. (2013). Exclusionary practices in two-sided markets. In Hawk, B. E., editor, *Proceedings of the 39th Fordham Competition Law Institute International Conference on Antitrust Law and Policy*, pages pp. 537–564, New York. Juris.

Gowrisankaran, G. and Rysman, M. (2012). Dynamics of consumer demand for new durable goods. *Journal of Political Economy*, 120:1173–1219.

Rysman, M. and Simcoe, T. (2011). A NAASTY alternative to RAND pricing commitments. *Telecommunications Policy*, 35:1010–1017.

Crowe, M., Rysman, M., and Stavins, J. (2010). Mobile payments at the retail point of sale in the United States: Prospects for adoption. *Review of Network Economics*, 9.

Mehta, A., Rysman, M., and Simcoe, T. (2010). Identifying the age profile of patent citations. *Journal of Applied Econometrics*, 25:1179–1204.

De Stefano, M. and Rysman, M. (2010). Competition policy as strategic trade with differentiated products. *Review of International Economics*, 18:758–771.

Rysman, M. (2010). Consumer payment choice: Measurement topics. In *The Changing Retail Payments Landscape: What Role for Central Banks? An International Payment Policy Conference*, pages 61–81. Federal Reserve Bank of Kansas City.

Rysman, M. (2009). The economics of two-sided markets. *Journal of Economic Perspectives*, 23:125–144.

Rysman, M. and Simcoe, T. (2008). Patents and the performance of voluntary standard setting organizations. *Management Science*, 54:1920–1934.

Rysman, M. (2007a). Empirical analysis of payment card usage. *Journal of Industrial Economics*, 60:1–36.

Rysman, M. (2007b). Empirics of antitrust in two-sided markets. *Competition Policy International*, 3:197–209.

Greenstein, S. and Rysman, M. (2007). Coordination costs and standard setting: Lessons from 56k modems. In Greenstein, S. and Stango, V., editors, *Standards and Public Policy*, pages 123–159. Cambridge University Press.

Rysman, M. and Simcoe, T. (2007). The performance of standard setting organizations: Using patent data for evaluation. *Journal of IT Standards and Standardization Research*, 5:25–40.

Augereau, A., Greenstein, S., and Rysman, M. (2006). Coordination vs. differentiation in a standards war: 56k modems. *RAND Journal of Economics*, 37:887–909.

Ackerberg, D. A. and Rysman, M. (2005). Unobservable product differentiation in discrete choice models: Estimating price elasticities and welfare effects. *RAND Journal of Economics*, 36:771–788.

Busse, M. and Rysman, M. (2005). Competition and price discrimination in Yellow Pages advertising. *RAND Journal of Economics*, 36:378–390.

Rysman, M. and Greenstein, S. (2005). Testing for agglomeration and dispersion. *Economics Letters*, 86:405–411.

Rysman, M. and Simcoe, T. (2005). Evaluating the performance of standard setting organizations with patent data. In Egyedi, T. and Sherif, M., editors, *Proceedings of the 4th International Conference on Standardization and Innovation in Information Technology*, pages 195–206, Geneva. IEEE.

Rysman, M. (2004). Competition between networks: A study of the market for Yellow Pages. *Review of Economic Studies*, 71:483–512.

Rysman, M. (2002). Review of the book: The economics of network industries, by Oz Shy. *Journal of Economic Literature*, 40:556–557.

Rysman, M. (2001). How many franchises in a market? *International Journal of Industrial Organization*, 19:519–542.

WORKING PROJECTS

Rysman, M., Townsend, R. M., and Walsh, C. (2022). Branch location strategies and financial service access during the Thai financial crisis. Unpublished Manuscript, Boston University.

Ho, C.-Y., Rysman, M., and Wang, Y. (2021). Demand for performance goods: Import quotas in the Chinese movie market. Unpublished manuscript, Boston University.

Chen, M., Rysman, M., Wang, S., and Wozniak, K. P. (2020). Payment instrument choice with scanner data: An MM algorithm for fixed effects in non-linear models. Unpublished manuscript, Boston University.

Gowrisankaran, G. and Rysman, M. (2020). A framework for modeling industry evolution in dynamic demand models. Unpublished Manuscript, Boston University.

Rapson, D. S., Rysman, M., and Wang, S. (2020). The impact of the Zero Emissions Vehicles mandate on the California automobile market.

Kaido, H., Li, J., and Rysman, M. (2018). Moment inequalities in the context of simulated and predicted variables. Unpublished manuscript, Boston University.

McCalman, P. and Rysman, M. (2019). Airline services agreements: A structural model of network formation. Unpublished Manucript, Boston University.

Cohen, M., Rysman, M., and Wozniak, K. (2017). Payment choice with consumer panel data. Unpublished Manuscript.

Gowrisankaran, G., Park, M., and Rysman, M. (2017a). Measuring network effects in a dynamic environment. Unpublished Manuscript, Boston University.

Gowrisankaran, G., Rysman, M., and Yu, W. (2017b). Computing price cost margins in a durable goods environment. Unpublished Manuscript, Boston University.

Rysman, M. (2003). Adoption delay in a standards war. Unpublished manuscript, Boston University.

Rysman, M. (2000). Competition policy as strategic trade. Industry Studies Project Working Paper, #100, Boston University.

GRANT ACTIVITY

"Estimation and Computation of Dynamic Oligopoly and Network Effects Models", with Gautam Gowrisankaran. National Science Foundation, SES-0922629, 2009-2013.

"Dynamic Demand for New Durable Goods: An Empirical Model and Applications to Pricing and Welfare," with Gautam Gowrisankaran. National Science Foundation, SES-0551348, 2006-2009.

"Discrete adjustment costs, investment dynamics, and productivity growth: Evidence from Chilean manufacturing plants", with Simon Gilchrist. National Science Foundation, SES-0351454, 2004-2006.

"Empirical Studies of Network Effects", National Science Foundation, SES-0112527, 2001-2002.

COURSES TAUGHT

EC333 Market Organization and Public Policy (Antitrust and Regulation): Fall 1999, Fall 2000, Spring 2002-2003, Spring 2005-2011, Fall 2008-2011, Spring 2016, Spring 2020, Fall 2020.

EC732 Topics In Industrial Organization (Graduate Empirical IO): Spring 2000-2001, Fall 2001, Spring 2003, Fall 2004, Spring 2005-2013, Spring 2016-2022.

EC711 Topics in Econometrics: Spring 2010-2011.

EC709 Advanced Econometrics II: Fall 2006, Fall 2015, Fall 2017-2018.

EC201/303 Intermediate Microeconomics: Fall 2001, Fall 2002, Fall 2005.

EC903 Graduate Student Seminar: Fall 1999, Fall 2000.

HONORS AND AWARDS

Neu Family Award for Teaching Excellence in Economics, 2006, 2012.

Networks, Electronic Commerce and Telecommunications (NET) Institute Grant, 2009.

Professor of the Year, 2006-2007, awarded by Boston University Fraternities and Sororities

Networks, Electronic Commerce and Telecommunications (NET) Institute Grant, 2005.

Networks, Electronic Commerce and Telecommunications (NET) Institute Grant, 2003.

Gerald M. Gitner Award for Excellence in Undergraduate Teaching, 2000.

Christensen Award in Empirical Economics, 1997 (with Phil Haile).

MEMBERSHIPS

American Economic Association

International Industrial Organization Society

TESTIMONY EXPERIENCE

- *Independent Living Resource Center of San Francisco, et al. v. Lyft, Inc.* (US District Court, Northern District of California, Case No. C-19-01438). Deposition in August 2020 and trial testimony in June 2021.

- *Twentieth Century Fox Film v. Wark Entertainment*, JAMS Ref. No. 1220052735. Deposition in June 2018 and trial testimony in August 2018.

OTHER LITIGATION AND REGULATORY EXPERIENCE

- Retained as a testifying expert by performing rights organization in the determination of the allocation of retransmission fees by the Copyright Royalty Board, 2022.

- Retained as a testifying expert by music publishers for antitrust counterclaims in a copyright infringement case, January 2020.

- Retained as a testifying expert by banks in a foreign antitrust case involving payment cards, 2018-2019.

- Retained as a testifying expert in a confidential FRAND Arbitration, Hong Kong International Arbitration Centre, 2019.

- Retained as an expert in a group of antitrust cases in the high-tech sector involving FRAND and unilateral conduct issues, 2018.

- Wrote "Stock Exchanges as Platforms for Data and Trading," for the New York Stock Exchange, which NYSE submitted to the SEC as part of a regulatory filing, December 2019. A follow-up report was filed in July 2020.

- Advocacy presentation to the Antitrust Division of the Department of Justice on a matter involving standard setting in a technology industry, March 2020.

- Wrote a white paper for the Federal Communication Commission studying market power in the business data services market, which influenced rulemaking: "Empirics of business data services." Appendix B of Business Data Services Federal Notice of Proposed Rulemaking, FCC 1654, 2016.

- Commissioned to write and present a paper on interchange fee policy and its effect on competition in the payments card market to the members of the Board of Governors of the Federal Reserve Bank. The paper was entitled "Payment Networks," and the event was formally titled as the "Academic Consultant's Conference for the members of the Board of Governors." September 2012. I presented directly to Chairman Bernanke, Vice Chairman Yellen and the rest of the Board of the Governors

OTHER CONSULTING EXPERIENCE

- Academic Panel Member, Competition and Markets Authority, United Kingdom, 2016 to 2020. I was called on periodically to provide advice on CMA cases.

- Served as an academic consultant to the Consumer Payments Research Center at the Federal Reserve Bank of Boston 2009-2019.

- Served as a consultant to the Association of Directory Publishers in their advocacy to various state and municipal governments on the benefits of competition in the Yellow pages market, 2007.

Appendix B
Materials Relied Upon

I.   Expert Reports

- "Expert Report of Catherine E. Tucker," *In re Google Play Store Antitrust Litigation*, Case No. 3:21-md-02981-JD, November 18, 2022.

- "Expert Report of Donna L. Hoffman, Ph.D.," *In re Google Play Store Antitrust Litigation*, Case No. 3:21-md-02981-JD, November 18, 2022.

- "Expert Report of Douglas J. Skinner," *In re Google Play Store Antitrust Litigation*, Case No. 3:21-md-02981-JD, November 18, 2022.

- "Expert Report of Dr. Gregory K. Leonard Errata," *In re Google Play Store Antitrust Litigation*, Case No. 3:21-md-02981-JD, November 30, 2022.

- "Expert Report of Dr. Gregory K. Leonard," *In re Google Play Store Antitrust Litigation*, Case No. 3:21-md-02981-JD, November 18, 2022.

- "Expert Report of Dr. Marc Rysman," State of Utah et al. v. Google LLC et al., Case No. 3:21-cv-05227, October 3, 2022.

- "Expert Report of Matthew Gentzkow," *In re Google Play Store Antitrust Litigation*, Case No. 3:21-md-02981-JD, November 18, 2022.

- "Expert Report of Sandeep Chatterjee, Ph.D.," *In re Google Play Store Antitrust Litigation*, Case No. 3:21-md-02981-JD, November 18, 2022.

- "Expert Report of Zhiyun Qian," *In re Google Play Store Antitrust Litigation*, Case No. 3:21-md-02981-JD, November 18, 2022.

- "Merits Report of Hal J. Singer, Ph. D.," *In re Google Play Store Antitrust Litigation*, Case No. 3:21-md-02981-JD, October 3, 2022.

- "Supplement to Initial Expert Report of Matthew Gentzkow," *In re Google Play Store Antitrust Litigation*, Case No. 3:21-md-02981-JD, December 7, 2022.

II.   Depositions and Associated Exhibits

- Deposition of Aashish Patel, Director of Product Management at NVIDIA, September 29, 2022.

- Deposition of Adrian Ong, Senior Vice President of Operations at Match Group, February 24, 2021.

- Deposition of Anthony DiVento, Accounting Controller for Google Play at Google, September 8, 2022.

- Deposition of Ben Goodger, General Manager at Google, September 7, 2022.

- Deposition of Brian Vogelsang, Senior Director of Product Management at Qualcomm, November 10, 2022.

- Deposition of Christopher Babcock, Senior Platform Engineer at Epic Games, February 17, 2022.

- Deposition of Kaori Miyake, Head of Product Communications, Android and Google Play, November 1, 2022.

III.   Data, Associated Documentation, and Correspondence

- Google Monthly App Revenue Data

  GOOG-PLAY-009908837

- RSA Transactions Data

  GOOG-PLAY-011657415; GOOG-PLAY-011657416; GOOG-PLAY-011657417; GOOG-PLAY-011657418; GOOG-PLAY-011657419; GOOG-PLAY-011657420; GOOG-PLAY-011657421; GOOG-PLAY-011657422; GOOG-PLAY-011657423; GOOG-PLAY-011657424; GOOG-PLAY-011657425

- "IDC's Worldwide Mobile Phone Tracker Taxonomy 2020"

  "IDC's Worldwide Mobile Phone Tracker Taxonomy 2020"

IV.   Produced Documents

- AMZ-GP 00002471
- AMZ-GP_00003873
- AMZ-GP_00005705
- GOOG-PLAY-000091853.R
- GOOG-PLAY-000094746
- GOOG-PLAY-000272539.R
- GOOG-PLAY-000289306
- GOOG-PLAY-000300552.R
- GOOG-PLAY-000314953.R
- GOOG-PLAY-000375525.R
- GOOG-PLAY-000565846
- GOOG-PLAY-000571373.R
- GOOG-PLAY-000571992
- GOOG-PLAY-000879069
- GOOG-PLAY-001442316
- GOOG-PLAY-001490474
- GOOG-PLAY-001507601
- GOOG-PLAY-001507602
- GOOG-PLAY-001507772
- GOOG-PLAY-001925008
- GOOG-PLAY-002432994.R
- GOOG-PLAY-002653755.R
- GOOG-PLAY-002863312
- GOOG-PLAY-003778936
- GOOG-PLAY-003894142
- GOOG-PLAY-004235367
- GOOG-PLAY-004453915
- GOOG-PLAY-004488106.R
- GOOG-PLAY-004537618
- GOOG-PLAY-004708826
- GOOG-PLAY-005535885
- GOOG-PLAY-005535888
- GOOG-PLAY-005570952.R
- GOOG-PLAY-005577045
- GOOG-PLAY-005705974.R
- GOOG-PLAY-006861555
- GOOG-PLAY-007203253
- GOOG-PLAY-007310413
- GOOG-PLAY-007335206
- GOOG-PLAY-007622187
- GOOG-PLAY-009209478
- GOOG-PLAY-009436873
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- GOOG-PLAY-011461351
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Appendix C
Technical Appendix

I.   Incorporating Alternative Rates of Price Sensitivity to Commission in the Damages Model

1.   My damages model can be easily modified to allow for various sensitivities of price to commission. Define sensitivity rate, γ, as:

$$\gamma = \frac{(p_2 - p_1)}{(\tau_2 p_2 - \tau_1 p_1)}$$

E. 1

2.   This is one measure of sensitivity of price to commission and represents price change as a percentage of change in the \$ commissions per transaction. Note that when the number of apps is high, an implication of my model would be that $\frac{(p_2-p_1)}{(\tau_2 p_2 - \tau_1 p_1)} \approx 1$. This follows from substituting for p_2 and p_1, in E. 1 above, from E.2 in the Appendix F of the Rysman Opening Report and fixing n. Introducing the free parameter γ allows me to relax this implication of my model and to incorporate sensitivity rates below 1. For example, if I set $\gamma = 0.911$ then,[1] from E. 1, price under τ_2 can be solved as: $p_2 = p_1 \frac{(1-0.911\tau_1)}{(1-0.911\tau_2)}$, or more generally

$$p_2 = p_1 \frac{(1 - \tau_1 \gamma)}{(1 - \tau_2 \gamma)}$$

E. 2

3.   I assume that prices are determined according to E. 2. Given the prices, firms make entry decisions as in my damages model.

4.   As previously, the percentage overcharge to consumers due to the higher commission or lower Play Points is determined by the following formula:

$$\% \, overcharge = \frac{(1 - t_{B_2})p_2 - (1 - t_{B_1})p_1}{(1 - t_{B_1})p_1}$$

---

[1] This is Dr. Singer's pass-through estimates. *See* Singer Merits Report, p. 138.

<div align="right">E. 3</div>

5.   Here p_1 is recovered from the data while p_2 is solved for using E. 2.

6.   In Appendix F of Rysman Opening Report, I show that the total welfare effect (in $) due to a lower commission and higher Play Points in the but-for world is represented as:

$$\Delta y = y \times \left[\frac{p_1(1 - t_{B_1})\, n_2^{\rho-1}}{p_2(1 - t_{B_2})\, n_1^{\rho-1}} - 1 \right]$$

<div align="right">E. 4</div>

7.   Substituting for n_2 and n_1 from the free entry condition (*i.e.,* setting profits, from E.3 in Appendix F of Rysman Opening Report, to zero to solve for the number of apps), I obtain:

$$\Delta y = y \times \left[\left[\frac{p_1(1 - t_{B_1})}{p_2(1 - t_{B_2})} \right]^{\rho} \left[\frac{(1 - \tau_2)p_2 - c}{(1 - \tau_1)p_1 - c} \right]^{\rho-1} - 1 \right]$$

<div align="right">E. 5</div>

8.   I use E. 5 above to calculate total welfare effects. For comparison, in my workpapers, I provide welfare effects using Dr. Singer's and Dr. Leonard's pass-through rates.[2]

II.   Extension of The Damages Model with Heterogeneity

9.   I start with my baseline damages model but assume that there is a large pool of apps such that each developer does not internalize the effect of their price on price index.[3] I also explicitly allow for heterogeneity across firms.

10.   The utility function can be written as:

$$u = \left(\int_{\omega \in \Omega} (a(\omega)q(\omega))^{1/\rho}\, d\omega \right)^{\rho}$$

---

[2] *See* Rysman Workpapers.

[3] Dr. Leonard also agrees that "[w]hen the number of firms on the market n and consumer budget y is large, the model's predicted market outcomes with more and less relaxed assumptions are very similar." *See* Leonard Report, footnote 14.

E. 6

11.   Where the set Ω represents the mass of the goods and ω indexes a good (*e.g.* app). Following similar derivations as in my baseline model, consumer's demand for good ω is:

$$q(\omega) = \frac{y}{1 - t_B} \times \frac{(a(\omega)\bar{p})^{\frac{1}{\rho-1}}}{p(\omega)^{\frac{\rho}{\rho-1}}}$$

E. 7

12.   The price index is:

$$\bar{p} = \left(\int_{\omega \in \Omega} \left[\frac{p(\omega)}{a(\omega)} \right]^{\frac{-1}{\rho-1}} d\omega \right)^{1-\rho}$$

13.   As in my baseline model, apps first make entry decisions and then set the prices. Each app, ω, is associated with its quality $a(\omega)$ and marginal cost $c(\omega)$. After entering the app store, each app maximizes profits conditional on $a(\omega)$ and $c(\omega)$. This leads to the following first order condition for profit-maximization:

$$(1 - \tau)p(\omega)^{\frac{-\rho}{\rho-1}} = \frac{\rho}{\rho - 1} p(\omega)^{\frac{-\rho}{\rho-1}-1}((1 - \tau)p(\omega) - c_i)$$

14.   The optimal price is:

$$p^*(\omega) = \frac{\rho c(\omega)}{1 - \tau}$$

E. 8

15.   In equilibrium, there is some equilibrium distribution of quality and marginal costs which determines distribution of prices and quantities. The equilibrium is characterized by the number of firms, n, and a distribution of quality and marginal costs, $\mu(a, c)$, over a space Ξ. Let $\xi = (a, c)$. In such an equilibrium, the price index is given by:

$$\bar{p} = \left(\int_{\xi \in \Xi} \left[\frac{p(\xi)}{a(\xi)} \right]^{\frac{-1}{\rho-1}} n\mu(\xi)d\xi \right)^{1-\rho}$$

E. 9

16.   The expected profit of a firm at the point of making an entry decision is obtained by substituting for the equilibrium prices from E. 8 and equilibrium distribution of quality and marginal costs in the firm's profit function:

$$\frac{(1-\tau)(\rho-1)y}{(1-t_B)\rho n} \times \frac{\left[\frac{a(\omega)}{c(\omega)}\right]^{\frac{1}{\rho-1}}}{\int_{\xi\in\Xi}\left[\frac{a}{c}\right]^{\frac{1}{\rho-1}}\mu(\xi)d\xi} - F$$

E. 10

17.   Substituting equilibrium $q(\omega)$ in E. 6, consumer welfare can be written as:

$$V = n^{\rho-1} \times \frac{(1-\tau)y}{(1-t_B)\rho}\left(\int_{\xi\in\Xi}\left[\frac{a}{c}\right]^{\frac{1}{\rho-1}}\mu(\xi)d\xi\right)^{\rho-1}$$

E. 11

18.   When there is complete unpredictability, in equilibrium, the expectation of $\left[\frac{a(\omega)}{c(\omega)}\right]^{\frac{1}{\rho-1}}$ from individual developer's perspective is $\int_{\xi\in\Xi}\left[\frac{a}{c}\right]^{\frac{1}{\rho-1}}\mu(\xi)d\xi$. Using this in the E. 10, and using free entry condition, which implies that firms enter such that their expected profits equal zero, the equilibrium number of apps is:

$$n = \frac{(1-\tau)(\rho-1)y}{(1-t_B)\rho F}$$

E. 12

19.   E. 12 is very close to E.4 in the Appendix F of Rysman Opening Report which is equal to this value plus $1/\rho$. Since $\rho \geq 1$ the two models differ by at most one firm. This also coincides with the predicted equilibrium number of apps in my baseline model under the assumption that the number of apps is large enough such that individual firms don't consider the effect of their prices on the price index.[4]

---

[4] To show that my baseline model generates the same equation, substitute price from footnote 7 of Appendix F of Rysman Opening Report into E.3 from Appendix F of Rysman Opening Report, equate to 0, and solve for n.

20. Under complete unpredictability, the variety damages (under the assumption of complete price stickiness) and total welfare damages are, respectively:

$$\Delta y = y \times \left(\left[\frac{(\rho(1 - \tau_2) - (1 - \tau_1))}{((\rho - 1)(1 - \tau_1))} \frac{(1 - t_{B_1})}{(1 - t_{B_2})} \right]^{\rho - 1} - 1 \right)$$

E. 13

$$\Delta y = y \times \left[\left(\frac{(1 - \tau_2)(1 - t_{B_1})}{(1 - \tau_1)(1 - t_{B_2})} \right) \times \left(\frac{(1 - \tau_2)(1 - t_{B_1})}{(1 - \tau_1)(1 - t_{B_2})} \right)^{\rho - 1} - 1 \right]$$

E. 14

21. These expressions are the same as in my baseline model under the assumption that number of apps is large enough such that individual firms don't consider the effect of their prices on the price index.[5]

22. Hence, under the assumption of complete unpredictability, for my purposes, it does not matter whether I start with a model that accounts for quality and marginal cost heterogeneity in the population or whether I start with the "aggregate" or "average" model that I used in my opening report.

III.   SSNIP Threshold With Free Transactions

23. I start from the inequality in Rysman Opening Report, Appendix F ¶ 49 but add an additional marginal cost C_{Free} for a "free transaction" to distinguish from the marginal cost of paid transactions C_{Paid} and letting Q_2 be the quantity of free transactions to distinguish from paid transactions Q_1 . Let $T^{**} = (1.1\tau^* - 0.9t_B^*)$, and $T^* = (\tau^* - t_B^*)$. The HM will raise price by a SSNIP if:

$$(T^{**}p^{**} - C_{\text{Paid}})Q_1^{**} - C_{\text{Free}}Q_2^{**} > (T^*p^* - C_{\text{Paid}})Q_1^* - C_{\text{Free}}Q_2^*$$

$$C_{\text{Paid}}\Delta Q_1^* > T^*p^*Q_1^* - T^{**}p^{**}Q_1^* + T^{**}p^{**}\Delta Q_1^* - C_{\text{Free}}\Delta Q_2^*$$

$$C_{\text{Paid}} > \frac{T^*p^*Q_1^* - T^{**}p^{**}Q_1^* + T^{**}p^{**}\Delta Q_1^*}{\Delta Q_1^*} - C_{\text{Free}}\frac{\Delta Q_2^*}{\Delta Q_1^*}$$

---

[5] To show that my baseline model generates the same equations, use price from footnote 7 of Appendix F of Rysman Opening Report to arrive to counterparts of E.9 and E.10 in Appendix F of Rysman Opening Report.

$$C_{\text{Paid}} > \frac{T^{**}p^{**}\frac{\Delta Q_1^*}{Q_1^*} - T^{**}p^{**} + T^*p^*}{\frac{\Delta Q_1^*}{Q_1^*}} - C_{\text{Free}}\frac{\Delta Q_2^*}{\Delta Q_1^*}$$

$$C_{\text{Paid}} > \frac{T^{**}p^{**}\epsilon_{Q,p} - \frac{(T^{**}p^{**} - T^*p^*)p^*}{p^{**} - p^*}}{\epsilon_{Q,p}} - C_{\text{Free}}\frac{\Delta Q_2^*}{\Delta Q_1^*}$$

To get the equation in the body of the report, let $-\frac{\Delta Q_2^*}{\Delta Q_1^*} = Diversion_{Paid\ to\ Free}$, and note that the first term on the right-hand side is the marginal cost threshold in E.15 of Appendix F in my Opening Report.

Appendix D

Android Smartphone Device Unit Sales by OEM

Exhibit D.1
Android Smartphone Device Unit Sales by OEM Worldwide, 2016 - 2021

Company	2016	2017	2018	2019	2020	2021
Samsung	34.57%	35.94%	34.61%	34.54%	32.31%	32.00%
Xiaomi	1.40%	4.46%	8.20%	10.10%	13.80%	16.55%
Transsion	2.14%	3.41%	4.64%	4.98%	7.71%	9.75%
OPPO	2.60%	3.69%	4.13%	6.08%	6.91%	7.87%
vivo	0.99%	2.26%	3.02%	5.14%	6.88%	6.78%
realme	0.00%	0.00%	0.57%	2.78%	5.03%	6.36%
Lenovo	5.64%	5.89%	4.75%	4.64%	4.25%	6.00%
TCL	3.88%	2.23%	2.05%	1.99%	1.63%	1.93%
OnePlus	0.26%	0.29%	0.49%	0.60%	0.69%	1.23%
HMD	0.00%	1.05%	2.04%	1.49%	1.02%	1.23%
Huawei	6.92%	6.65%	9.92%	9.47%	6.64%	1.21%
LG Electronics	6.69%	6.60%	4.74%	3.58%	3.11%	1.00%
ZTE	4.00%	3.24%	1.18%	0.79%	0.70%	0.89%
Google	0.22%	0.41%	0.56%	0.84%	0.47%	0.55%
Sharp	0.38%	0.40%	0.53%	0.50%	0.53%	0.51%
Kyocera Group	0.50%	0.54%	0.41%	0.28%	0.32%	0.43%
Sony	1.79%	1.62%	0.97%	0.48%	0.37%	0.36%
BLU	0.91%	0.66%	0.51%	0.26%	0.35%	0.35%
Fujitsu	0.22%	0.26%	0.23%	0.29%	0.35%	0.31%
Wiko	0.78%	0.82%	0.75%	0.45%	0.38%	0.27%
Honor	0.71%	0.85%	2.21%	2.32%	1.50%	0.24%
Hisense	0.27%	0.47%	0.31%	0.28%	0.20%	0.19%
Mobicel	0.34%	0.29%	0.40%	0.22%	0.26%	0.13%
Micromax	1.40%	0.78%	0.79%	0.12%	0.05%	0.09%
Lava	1.07%	0.72%	0.55%	0.26%	0.11%	0.08%
Cherry Mobile	0.45%	0.43%	0.43%	0.27%	0.11%	0.07%
ASUS	1.87%	1.49%	1.10%	0.53%	0.16%	0.07%
Coolpad	0.63%	0.38%	0.20%	0.25%	0.11%	0.03%
HTC	1.48%	0.69%	0.19%	0.07%	0.03%	0.02%
Q-Mobile (PK)	0.72%	0.68%	0.29%	0.10%	0.03%	0.01%
Others	17.16%	12.80%	9.22%	6.31%	3.99%	3.49%
TOTAL	**83%**	**87%**	**91%**	**94%**	**96%**	**97%**

Source: IDC, "IDC Quarterly Mobile Phone Tracker, 2021Q4 Historical Release," February 11, 2022.

Exhibit D.2
Android Smartphone Device Unit Sales by OEM U.S., 2016 - 2021

Company	2016	2017	2018	2019	2020	2021
Samsung	38.81%	39.75%	42.37%	40.78%	47.20%	49.50%
Lenovo	3.87%	5.72%	10.10%	10.84%	11.63%	16.92%
TCL	9.73%	5.51%	8.41%	11.23%	8.55%	8.70%
LG Electronics	20.84%	22.68%	22.01%	19.49%	18.72%	4.89%
Google	1.26%	2.18%	3.53%	5.53%	2.55%	3.77%
OnePlus	0.61%	0.67%	0.91%	1.25%	1.03%	3.44%
BLU	1.76%	1.82%	1.90%	1.02%	1.83%	2.19%
ZTE	13.34%	15.30%	6.17%	2.18%	1.06%	0.51%
Coolpad	1.94%	1.64%	1.38%	1.85%	1.16%	0.27%
HTC	3.41%	1.04%	0.25%	0.07%	0.00%	0.00%
Others	4.42%	3.68%	2.97%	5.76%	6.25%	9.81%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: IDC, "IDC Quarterly Mobile Phone Tracker, 2021Q4 Historical Release," February 11, 2022.